PROCEEDINGS AND TRANSACTIONS

OF THE

Croydon Microscopical & Natural History Club.

13TH FEB. 1884 TO 13TH JAN. 1892.

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OF THE

CROYDON

MICROSCOPICAL & NATURAL HISTORY

CLUB.

VOLUME III.

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CROYDON:

PRINTED FOR THE CLUB BY WEST, NEWMAN & CO.,

HATTON GARDEN, LONDON.

1892.

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FEBRUARY 13, 1889, TO JANUARY 15, 1890.

CROYDON:

PRINTED FOR THE CLUB, BY WEST, NEWMAN & CO., HATTON GARDEN, LONDON.

1890.

PROCEEDINGS

OF

THE CROYDON MICROSCOPICAL AND NATURAL HISTORY CLUB.

1889—90.

Twentieth Annual Meeting.

Held at the Public Hall, Croydon, Wednesday, January 15*th*, 1890.

Henry G. Thompson, M.D., President, in the chair.

The Balance-sheet of the accounts for the year 1889 was taken as read (page cxxii) and passed, and a vote of thanks accorded to the Auditors.

It was proposed by the President, seconded by Mr. H. T. Mennell, and carried unanimously :—

"That Mr. Edward Lovett be elected President for the ensuing year."

It was proposed by Dr. Carpenter, and seconded by Mr. H. Turner, that Mr. Kenneth McKean be re-elected Treasurer.

It was proposed by Mr. Eaton, and seconded by Mr. K. McKean, that Mr. F. C. Bayard be elected Honorary Secretary.

The above propositions were carried unanimously, and the elected officers thanked the Club for their election.

No other nominations having been received Mr. W. Murton Holmes, Mr. W. Low Sarjeant, Dr. A. B. Carpenter, Mr. J. W. Helps, Mr. Chas. F. Oakley, and Mr. C. H. Goodman, were elected to serve on the Committee in the place of Mr. F. C. Bayard, Mr. H. S. Cowdell, Mr. W. M. Gibson, Dr. G. J. Hinde, Mr. Ed. Lovett, and Mr. E. B. Sturge.

A vote of thanks to the retiring members of the Committee was proposed by Mr. Morland, seconded by Mr. Cushing, and carried unanimously.

The following is the list of officers for the year 1890:—

President.—Edward Lovett.

Vice-Presidents.—John Berney, F.R.M.S.; Alfred Carpenter, M.D., J.P., &c.; Philip Crowley, F.L.S., F.Z.S., &c.; Henry S. Eaton, M.A., F.R.Met.Soc.; Henry T. Mennell, F.L.S.; Henry G. Thompson, M.D.

Treasurer.—Kenneth McKean, F.L.S.

Hon. Secretary.—Francis C. Bayard, LL.M., F.R.Met.Soc.

Committee.—Dr. A. B. Carpenter, F.R.M.S., &c.; Thos. Cushing, F.R.A.S.; James Epps, jun., F.L.S.; C. H. Goodman; J. W. Helps; W. Murton Holmes; Chas. F. Oakley; W. Low Sarjeant; Ernest Straker.

The President then delivered his Address, at the conclusion of which it was proposed by Mr. Cushing, and passed unanimously, that a hearty vote of thanks be accorded to the President for his admirable Address, and also for his services during the past year.

Votes of thanks to other retiring officers were also passed and acknowledged. The proceedings then terminated.

The President's Address.

Gentlemen,—It has been customary for the President, at the Annual Meeting of this Club, to give a *resumé* of its working, progress, and general condition. I think it is acknowledged by all that no other Club of its kind (outside London) can show a better record of general usefulness, and efficiency than the Croydon Microscopical and Natural History Club.

During the past year 24 new members have been enrolled, 12 have resigned, and 2 have died. Of these the late Rev. J. Masterman Braithwaite, the Vicar of Croydon, was a man who took a keen interest in all scientific pursuits, notably in electricity, the knowledge of which science he did not keep to himself, but, in an ungrudging and liberal spirit, imparted to others, in his lectures at the Welcome Hall. Here he had for his audience those whom many would not take the trouble to interest, forming his class from the more intelligent of his lowly parishioners.

Dr. Whitling, whom we also deplore, brought to practical bearing his scientific knowledge, and thus indirectly reflected the work done by this Society in his extensive practice.

The muster-roll of our Club, at the present time, is 276 members, 7 honorary members, and 2 associates, making a total of 285 members. A list of our members up to date will be found in our Proceedings.

The Balance-sheet shows that during the past year we have received, in subscriptions £131 10s., from the sale of Soirée

tickets £14 7s. 6d., and from the sale of Transactions 7s. 0d., which, with the balance in hand on the 1st of January, 1889, £32 10s. 7d., amounted to £179 5s. 1d. On the other side, the payments have been £169 19s. 5d., leaving a balance in hand of £9 5s. 8d.

Special Fund.—Balance, 1st January, 1889, £38 16s. 2d.; dividends on $2\frac{3}{4}$ per cent. stock, £5 18s. 2d. On the other side, for payment, optical lantern and lenses complete, £13 10s. 3d.; 2 steel gas bottles and screen and stand, £5 9s. Balance of this fund in hand, 31st December, 1889, £25 15s. 1d. Balance at bankers, 31st December, 1889, £35 0s. 9d. Invested in $2\frac{3}{4}$ per cent. stock, £210 11s. 8d.

The reports of the different sections show that a large amount of work has been executed by the several Committees. Thus Mr. Mennell, the Honorary Secretary of the Botanical Sub-Committee, reports as follows:—

The Sub-Committee has made considerable progress with the arrangement and naming of the Club Herbarium; but the mounting of the specimens still remains to be done, and it may be necessary to employ paid assistance to accomplish it. Offers of voluntary help will, however, be gladly received as well as further contributions. Several members of the Club have during the past summer added to the Club collection. The conversational evenings for which this Committee was responsible have been devoted to the arrangement of the Herbarium. One of the excursions during the summer was also arranged by it, and was a very interesting and successful occasion. The locality chosen was the remarkable series of large ponds lying between Copthorne and Rowfant and Lingfield. They occupy a broad flat valley surrounded by wooded hills. Through the valley a stream flows which eventually finds its way into the Medway. The abundance of wood for conversion into charcoal, its nearness to the iron deposits of Tilgate Forest, together with the water-supply, naturally led to the selection of this locality for the establishment of the iron works both for smelting and forging. The valley was dammed across at three points with solid masonry, and three large ponds or lakes were thus artificially formed, the names of two of which, Hammer Pond and Wire Mill Pond, perpetuate their purpose, though the industry has long since completely disappeared from the district. The dams have gradually fallen into decay, thus lowering the level of the water, and leaving large marshy tracts about the margins, presenting in their scenery, surroundings and vegetation a close resemblance to the Fens and Broads of the Eastern Counties; all appearance of their artificial origin has long been obliterated. The party alighted at Horley Station, and drove thence by Burstow and Copthorne Common to within a short distance of the upper pond. By the roadside *Geranium striatum* was very abundant, but it was across the Surrey boundary, in Sussex. Devious, and not easily found, footpaths through thick woods, connect the ponds. In these woods the bird's-nest orchis (*Listera Nidus-avis*) was noticed. Here in spring also wild daffodils abound. The best botanical locality, however, is the extensive marsh at the head of the Middle or Wire Mill Pond. The smaller butterfly orchis (*Habenaria bifolia*) and the

marsh thistle (*Carduus pratensis*) were abundant, as well as several species of sedges (*Carex pulicaris*, *stellulata*, and *ampullacea*), and an interesting form of *Carex vulgaris* var. *juncella*). The latter was very conspicuous with pure white stigmas and yellow anthers, flowering much later than other species of the genus. The lower pond (Hedgecourt) is the largest of the three, and most reminds the botanist of the Broads of Norfolk. On the margin there are great masses of the bog bean; and in deeper water the true bulrush (*Scirpus lacustris*) attains an unusual size and height. Large patches of the beautiful floating polygonum, and of the white water lily, adorn the surface of the water; and many interesting water weeds are to be found beneath it, amongst which the comparatively rare smaller bladder-wort (*Utricularia neglecta*) was found in abundance. On the ponds there are numerous water fowl, including wild Duck and Coot. To the artist and photographer the scenery is most attractive, and it is especially to be prized by all lovers of nature, seeing how deficient in water the Surrey landscape is. After partaking of tea in primitive fashion in a miller's cottage at the lower end of Hedgecourt Pond, the party walked to Lingfield Station and thence returned to Croydon.

Mr. Edward Lovett, the Honorary Secretary, reports of the Geological Sub-Committee:—

During the year, no sections, excavations or borings have been made in our district of sufficient importance to call for special remarks, or to be reported to the Club. There have been, however, a few minor diggings between Addiscombe and Shirley exposing more of the pebble and shell beds of the Park Hill series, thus proving their continuation in this direction. A new road is also being cut (December, 1889) in South Park Hill, and as it is being carried much lower than the present field level it has exposed the clay beds of this part, the difficult nature of working which is clearly seen. It has been thought desirable to make a small collection of geological photographs illustrating various rock sections, formations and similar characteristic features, for the Club Cabinet, and through the kindness of our friends on the Photographic Sub-Committee, a start has been made in this direction, and a series of twelve photographs bearing upon this subject was exhibited at our Soirée; they were taken by Messrs. McKean, Low Sarjeant, Collyer, and Goodman. The Sub-Committee will be glad of further assistance, and will be happy to give information as to what is required. The excursion in August was directed by the Geological Sub-Committee, when a visit was made to the chalky pebble beds at Caterham waterworks, the chalk escarpment, the gault brick-fields and the Fuller's earth pits at Nutfield; the tunnels of the latter were explored, and sections of strata were photographed during the day.

The Meteorological Sub-Committee has continued its work under the supervision of its Honorary Secretary, Mr. Bayard. The daily rainfall of 45 stations in the Club district has been tabulated every month, examined and corrected, and the results printed and issued to the observers and all members of the Club interested in the question, either before or within a very few days after the end of the month succeeding that to which the statistics

refer. In order to show the Club how great interest is taken in the question of rainfall, the Sub-Committee reports that the Honorary Secretary sends the returns to no fewer than 90 persons every month.

At the beginning of the year the Committee made a grant to the Meteorological Sub-Committee of £25; the expenditure has exceeded this by the small sum of £1 4s. 5d., an excess due to the fact that 14 months' payments have been made, owing to the printer's bill for the last few months of the year 1888 not having been received in that year. In future it is hoped that the expenditure will not exceed £25 per annum. The Club is much indebted to the Photographic Sub-Committee for photographing several of its stations, and also to the Borough engineer (Mr. Walker) for his courtesy on the occasion of its excursion to Addington. The report of the Meteorogical Sub-Committee will be found in the Transactions.

The Microscopical Sub-Committee, the Honorary Secretary of which is Mr. Murton Holmes, have prepared a list of slides in the cabinet of the Club up to this date. It is hoped that this will not only facilitate the use of these by our members, but lead to additions being made to the collection. This catalogue will be found in the Proceedings.

Mr. Berney, the Honorary Secretary of the Zoological Sub-Committee, writes, "that the only fact of interest to report was the great scarcity of insects during the past season."

The Photographic Sub-Committee, through its Honorary Secretary, Mr. Charles Hussey, reports as follows:—

During the past year the membership of the Section has increased from 31 to 43; some of the new comers being new members of the Club.

General meetings of the Section have been held on the first Friday of each month throughout the year, and have, as a rule, been well attended. Six Optical Lantern Exhibitions (exclusive of the Soirée) have been given; the quality of the slides showing a marked general improvement over those of last year.

In addition to the conversational meetings, the following papers have been read:—

"Stripping Films, and printing and enlarging on Transferotype, and Bromide papers," by Mr. H. S. Bellsmith.

"With a Camera through Southern Spain and Morocco," by Mr. Andrew Pringle. This was a lecture illustrated by photographs shown by the Club's optical lantern.

"The Collodio-Bromide Process for lantern-slides and transparencies," by Mr. Wm. Brooks.

"Art in its relation to Photography," by Mr. George Davison.

"Reducing and enlarging Photographs by artificial light," by Mr. W. Low Sarjeant.

"The Ferrous Oxalate Developer," by Mr. D. E. Goddard.

"The Wet Collodion Process," by Mr. Charles Hussey.

The following excursions have been made during the year:—May 14th, Oxted and neighbourhood. June 1st, Ockley and Capel. June 22nd, Betchworth to Brockham Green. July 6th, Reigate. August 10th, Lingfield. August 31st, Balcombe.

With the exception of the months of May and June, the year 1889 can hardly be said to have been favourable for out-door photography; good work has nevertheless been done by our members, and, in the majority of cases, slides have been made from their negatives for use in the Club lantern.

The fine optical lantern and kit purchased by the General Committee have proved of the greatest assistance to the Photographic Section, having been used regularly and with great satisfaction throughout the winter months.

The Sub-Committee desires to call the attention of the members of the Club to the great utility of photography as an aid to scientific investigation. The manipulatory difficulties are small and easily overcome, while the resulting photographs (either paper prints or, preferably, optical lantern-slides) are often of the greatest scientific value. The Sub-Committee and members of the Section will with pleasure assist any member of the Club who is desirous of taking up photography, either as an artistic recreation or as an aid to scientific study.

Assistance has already been given by members of the Photographic Section to the Geological and Meteorological Sections; in order, however, that the work may be systematised, it may be expedient, at a future time, to appoint a Photo-scientific Committee, consisting of (say) two members of each Section of the Club, to draw up a circular pointing out the best methods of securing photographs of scientific value, and the means by which these photographs may be most conveniently made available for general reference.

During the past year 6 excursions and the same number of photographic rambles were arranged, and were the means of imparting useful knowledge and recreation to those engaged, as we see from some of the reports which have been received. Unfortunately your President was never able to join in them, for although Bank Holidays come and go for many, those days are as other days to the medical man.

The ordinary Monthly Meetings have been fairly well supplied with Papers during the past year.

February 13th.—Mr. Lovett read a Paper (Trans., Art. 74) "On some practical hints and suggestions on the preparation of objects for the Microscope," in which he briefly referred to the various methods of preparing objects for the microscope, namely, dry, in cells in Canada balsam, glycerine jelly and fluids of different kinds; and gave some practical hints with regard to each. As the paper appears in our Transactions, further reference to its contents is unnecessary here.

March 13th.—Mr. Charles Hussey read a Paper "On the application of Photography to scientific research." He com-

menced by reviewing the great strides recently made in photography, and the numerous uses to which photography had been applied for scientific purposes. The medical man by its means could obtain a permanent record of the various changes taking place in the patient under his observation. The botanist had unfolded in his view the growth, the expanding and development of plants through all their varying changes. The zoologist, the extraordinary positions displayed by animals in walking, running and leaping, and every varying position of the wings of birds during their progress through the air. To the geologist it was almost indispensable by preserving the appearance of freshly exposed rock sections. By it the astronomer obtained records of the sun spots and those little understood and erratic projections from the sun's corona. Its use by the microscopist was patent to all, for by it he was enabled to enlarge that multitudinous and glorious display of the minute creatures inhabiting the earth. And lastly, it might be called a terror to evil doers, for, by the detective camera, they could be portrayed in the midst of their evil career.

April 10*th.*—Dr. Carpenter read a Paper "On Microscopic life in Sewer Air, as bearing on the question of Ventilation of Sewers." This paper which is of great practical interest to all interested in the health and prosperity of our town appears at length in our Transactions (Trans., Art. 75). In this highly instructive and scientific paper Dr. Carpenter from an early date showed how the proper ventilation of sewers was the means of averting disease in this town.

May 8*th.*—Mr. Robert Brodie read a Paper (Trans., Art. 76) "On Ancient and Modern Science." In this paper Mr. Brodie traced the gradual evolution of ancient science up to the probably more correct modern, and said although the modern was in accordance with a more enlightened and mature experience, he still gave great credit to the ancient scientists, who had to perform their experiments under great disadvantages, as they were unacquainted with the scientific instruments and data of the present time. It would be only taking up your time unnecessarily to further dilate on this subject, as a full report of it appeared in the Local Press, and an abstract kindly forwarded by Mr. Brodie will also be found in our Transactions.

September 11*th.*—At this meeting no paper was read, but the meeting was resolved into a conversational chat, during which many topics of an interesting nature were discussed.

October 9*th.*—There was an absence of a paper at this meeting also, but Mr. Mennell made some very interesting remarks on a recent visit to Strathpeffer, and especially on the "vitrified forts" as they are called, which occur in the North of Scotland in a belt across the island from Inverness to Fort Augustus.

The rock of which the hills round Strathpeffer are composed is a sandstone conglomerate. The forts are built up roughly of masses of this rock, to which after construction intense heat has been applied so that the whole surface is run together and vitrified. The suggestion is that the idea of so treating them arose first from the accidental effects of the beacon-fires which were lighted on them; however that may be, the practice seemed to prevail widely at some early period, probably about the 8th century, during the conflicts between Picts and Scots, and about twenty of these forts can still be traced across the country from Fort Augustus to Dingwall and Banff. The most conspicuous and largest of these is Knock Farril close to Strathpeffer. Mr. Mennell exhibited and described several rare plants from the neighbourhood of Strathpeffer, notably *Ajuga pyramidalis*, which grows on the bare conglomerate face of Tor Achilty. The beautiful little dwarf birch (*Betula nana*), an Arctic species, the Alpine arbutus (*Arctostaphyllos alpina*), the bearberry (*Arctostaphyllos uva-ursi*), and the dwarf cornel (*Cornus suecica*), all from Ben Wyvis. Mr. Murton Holmes, also made some observations on the preserving and mounting of Foraminifera, and exhibited specimens showing that in some media the markings were entirely obliterated, whilst in others they were clearly defined.

November 13*th*.—Mr. J. W. Helps read a Paper (Trans., Art. 77) "On some Coal-tar Products." The Lecturer gave a most interesting and instructive description of the many preparations obtained from Coal-tar, showing how an almost endless variety of colour may be produced by substitution and change in the relative position of its ultimate elements. He also told us that although the colours were legion, still there was an instability and difficulty in fixing them even by mordants. He also illustrated by diagrams the most approved means of extracting the different products in an economical way, by means of one apparatus, where, by regulating the temperature at fixed points, each product was arrested at the temperature which caused its formation. He also illustrated his Lecture by exhibiting a very fine series of the colours derived from Coal-tar, as well as of many of the other products to which he referred in his paper. The paper appears at length in our Transactions.

December 11*th*.—The President read "Some notes on the Comparative Anatomy of the Vertebrates." In this paper the President endeavoured to show the anatomical distinctions between the different divisions of the Vertebrates, pointing out how a slight difference of conformation of certain bones in the skeleton sometimes placed an animal in a relative situation one would have thought incompatible with its social position. He found when reading the paper he embraced too large a field to make it as instructive as he could have desired. He also finds

he arrived at a too hasty opinion as to the position one class (*viz.*, the Birds) occupied, placing them lower in the scale than they either socially or anatomically deserved, for on looking further into the subject he finds he ought to have located them with the Reptiles, under Huxley's order of Sauropsida. He therefore thinks an ample apology is due to the Birds, which he hopes their great friend and benefactor Mr. Crowley will duly convey to them.

The Conversational Meetings have been fairly well attended, and many matters of a highly interesting nature discussed.

The Twentieth Annual Soirée was held in the Large and Small Halls, and the old School of Art Room on the 20th of November, when 108 microscopes were exhibited by the following Clubs:—Croydon 36, Royal 7, Quekett 14, South London 10, Brockley and St. John's 6, Forest Hill 9, Greenwich 4, Holmesdale 6, Tower 3, and unattached 13.

In the Small Hall were displayed, by 41 exhibitors, many collections of an interesting and instructive character, amongst which we noticed a fine collection of photographs of all the known Great Auks' eggs, including Croydon's only one, the property of our friend Mr. Crowley; the well known, and always eagerly looked for, basket of flowers collected by Mrs. Miller found its usual place with an increased number of varieties. Mr. Helps had his very fine display of coal-tar products; and on a long table extending nearly across the room, was the large and very complete collection, by Mr. Lovett, of lamps, commencing at the most primitive of lights, ascending by a species of evolution to the most modern and almost perfect lamp. Mr. Crowley also gave us a display of his unique collection of butterflies and moths. Many other exhibitors placed for our edification collections, useful, curious and instructive.

In the old School of Art Room, two exhibitions of lantern-slides (prepared by the members of the Club) were given.

The total number of visitors and members present amounted to 630, being 60 below the total of the previous year. This falling off was not due to less interest being taken in the Club, but was caused chiefly by the Mission which was held in Croydon during the week we held our Soirée. However, in comfort we gained, if in pocket we lost, by their absence.

Having now traced the progress of the Club during the past year, it behoves us to see if we are satisfied with its prosperity; from my point of view I think we ought not to be, for when we consider we have 285 members and only an average of *27* attend our Monthly Meetings, we feel compelled to look round and ask

ourselves, What is the cause of this small attendance? Are the Meetings held on an inconvenient day? There is no doubt our day of Meeting accounts for the absence of some whom I know would like to be present, for on our night the Royal Microscopic and Geological Societies hold their Meetings, but even this would only account for the few. What is become of the many old and new members who stay away? If it were only the old members, I would be inclined to say perhaps they grow weary of the Meetings, or perhaps they have arrived at a time of life when they cannot come out in the evening, but I find the absentees include new members as well. Of these many may join in order to get tickets for the Annual Soirée. We may then ask ourselves, What of the Nine? and the only answer I can give is, I think we ought somehow or other to coax, induce, or even try gentle pressure on, our new members, to prevail on them to read short papers on any subject they are interested in, at our Monthly Meetings; thus we might lead them to do greater things later on; we should not expect them to give us those polished papers they might think necessary for a scientific society. I consider the constant practice of preparing short papers, so that we might have two or three read at a Meeting, would be a preparation for greater things in the near future. They must not be afraid of criticism, as kindly criticism leads the author to weigh well his statements before they are made, and even mistakes when pointed out make a lasting impression on the mind. In doing this I should be sorry to suggest the elimination of those excellent papers we have had read to us from time to time by outside friends. I only throw out this suggestion in order that we may be able to fill up those blank evenings which recur almost every session. In this way we may be enabled to do a double amount of good both to him who gives and to him who receives.

Members elected, 1889.

January 9th.—William Edgar Backwell, 1, Tennison Road, South Norwood. William Bullock, 20, Dingwall Road. Ralph Henry Crowley, Bramley Oaks, Bramley Hill. William Lucas Distant, F.G.S., Russell Hill Road, Purley. Thomas William Hall, F.E.S., 7, Princess Road, Selhurst. Charles Henry Burnaby Sparrow, 1, Chepstow Road. Samuel Stevens, F.L.S., Loanda, Beulah Hill, Upper Norwood.

February 13th.—A. Norrington, Homeside, Purley. Alfred Ernest Pinnell, Winchester Villa, Carshalton.

March 13th.—Thomas Duncan Aldous, 37, St. Peter's Road. James Gibb, 18, Outram Road. D. Everett Goddard, F.R.M.S., Wallington, Surrey. Charles Mansfield, The Lindens, Coombe Road. George Neall, 88, Lower Addiscombe Road. J. J. Pitman, 59, Dingwall Road. Felix Joseph Vergara, Java House, South Norwood.

April 10th.—Edgar F. Blow, 110, Lower Addiscombe Road. William Henry Maidlow, Elm Lodge, Park Hill Rise.

May 8th.—Howard Martin, Bolney Grange, Havelock Road. S. P. L. Phillips, Oxford House, Cherry Orchard Road.

Oct. 9th.—A. Stuart Blackett, 58, Southbridge Road, Croydon. Dr. Edward Pearl, Tavistock, Sylvan Road, Upper Norwood. Samuel Hodder Slade, Richmond House, South Norwood.

Nov. 13th.—Howard R. Wise, Beechfield, Bramley Hill.

Library and Collection.

The additions to the Library and Collection during the year 1889 are as follows :—

From Individuals.—Anonymous: Pamphlet on some forms of British Violas. F. C. Bayard: Miscellaneous Meteorological Pamphlets. W. H. Beeby: The Flora of Shetland and other Pamphlets. Dr. G. J. Hinde, F.G.S.: Paper on a true Calci-sponge from the Middle Lias of Northamptonshire. W. Murton Holmes: One dozen slides for the Cabinet. E. B. Sturge: Bulletin of Miscellaneous information, Royal Gardens, Kew. N. Waterall: Naturalist's Voyage round the World, by C. Darwin.

From Societies.—British Association for the Advancement of Science: Report, 1888 (Bath); Report of the Delegates of the Corresponding Societies, 1889, and the President's Address. County of Middlesex Natural History Society: Transactions. East Kent Natural History Society: Transactions. Hampshire Field Club: Papers and Proceedings, Nos. 1 and 2. Holmesdale Natural History Club: Proceedings. Manchester Microscopical Society: Annual Report, 1888. National Footpath Preservation Society: 4th Annual Report, and Report of the Barnlake Right-of-way. Northamptonshire Natural History Society: Journal, Nos. 34, 35, 36. Quekett Microscopical Club: Journal, 3 numbers. Royal Microscopical Society: Journal, 3 numbers. Smithsonian Institute: Report for 1886.

From Proprietors.—Essex Naturalist; Science Gossip.

Loan Collection.—Dr. Carpenter: Palæontographical Society, Publications up to date; Ray Society, Publications up to date.

Exhibits, 1889.

Feb. 13th.—C. H. Goodman, Insects preserved in fluid on a tablet form for cabinet exhibition. W. Murton Holmes, The annelid *Aphrodita aculeata* or sea mouse (in spirit). Ed. Lovett (to illustrate his paper), A series of fluid preparations of embryo Crustaceans, Mollusca, Fish, Insecta, &c.

March 13th.—Ed. Lovett, Photographs of Geological, Ethnological and Botanical interest. R. McLachlan, A fine photo-process print of a series of moths of the genus *Agrotis*. N. Waterall, Specimens of Italian marble and Vesuvius rocks.

April 10th.—Dr. A. Carpenter, Pine needles formed into a ball and felted together, found on the surface of water at Ellesmere. W. Murton Holmes, Series of drawings of sponge spicules. C. H. Jolliffe, Aspirator charged with bacteria. K. McKean, *Testacella haliotidea* (alive) from Highbury. W. J. Nation, Roots of ivy formed in a dense mass of fibre in the hollow of a drain-pipe.

May 8th.—J. Drage, Imago and pupa-case of the Hawthorn Sawfly. Ed. Lovett, Engravings of Microscopical and Natural History specimens, early part of 18th Century.

Sept. 11th.—F. C. Bayard, Stem of sycamore constricted by a ligature. Ed. Lovett, Flint knives, hammers, and cores from Belgium. C. F. Oakley, Micro- and other photographs. W. Low Sarjeant, *Volvox globator* and other pond life, collected during the Club's excursion to Sutton. N. Waterall, Nest of a robin from a basket hung up in an outhouse.

Nov. 13th.—J. W. Helps (in illustration of his paper), A large series of colours and other products obtained from coal-tar.

Dec. 11th.—Dr. A. B. Carpenter, Lignite and fossils with pyrites from an excavation near Shirley. C. H. Goodman, Skulls of tiger, pig, gavial and porpoise. Ed. Lovett, Ear-bones of recent and fossil Cetaceans. Kenneth McKean, Benzole solidified by the addition of a wood extract. Dr. H. G. Thompson (to illustrate his Lecture), Sundry anatomical specimens.

List of Exhibitors of Microscopes and Objects of Interest at Twentieth Annual Soirée, November 20th, 1889.

Croydon (40).—W. Aldridge, Frank Allen, J. H. Baldock, F. C. Bayard, J. Berney, J. A. Carter, H. C. Collyer, P. Crowley, W. H. Cullis, F. W. East, J. Epps, jun., W. M. Gibson, C. H. Goodman, H. D. Gower, W. Murton Holmes, A. C. Hovenden, G. S. Hovenden, H. M. Klaassen, C. H. Lanfear, H. Long, E. Lovett, M. E. Lownds, W. H. Maidlow, K. McKean, H. T. Mennell, W. F. Miller, W. J. Nation, C. F. Oakley, H. F. Parsons, P. W. Perkins-Case, W. Pool, A. W. Rich, W. L. Sarjeant, E. L. Shore, J. Stanley, E. Straker, E. B. Sturge, J. W. Young, N. Waterall, and A. Warner.

Brockley and St. John's (6).—G. Berry, G. P. Berry, E. Carlile, J. T. Holder, A. J. Mitchell, and A. J. Robertson.

Forest Hill (9).—J. O. Boyes, H. H. Cowley, T. D. Fenner, E. George, Miss Lownds, M. E. Lownds, J. H. Stanley, C. F. Worters, and J. H. Worters.

Greenwich (4).—J. Beale, W. B. Bradford, W. Dannatt, and S. J. Weare.

Holmesdale (7).—F. Bossey, Colonel Clarke, A. B. Gough, D. P. Poulter, C. E. Salmon, E. S. Salmon, and W. F. Tindall.

Metropolitan Scientific Association (1).—C. West.

Quekett (15).—F. W. Andrew, J. W. Bailey, E. Bartlett, W. J. Brown, H. A. Crowhurst, A. J. Jenkins, G. A. Messenger, J. H. Oliver, G. D. Plomer, F. D. Rudkin, A. Smith, A. T. Spriggs, A. F. Tait, W. W. Taylor, and W. Watson.

Royal (7).—H. Epps, F. W. Hembry, R. Macer, C. Rousselet, G. J. Smith, J. J. Vezey, and T. P. Watson.

South London (10).—H. G. Coombes, A. L. Corbett, R. Elliott, T. D. Ersser, C. H. Oakden, F. Reeve, J. A. Smith, W. B. Smith, D. Ward, and W. West.

South London Entomological (4).—R. Adkin, H. A. Auld, H. W. Barker, and J. R. Wellman.

Sutton (1).—A. W. Bawtree.

Sydenham and Forest Hill (1).—E. W. Perrins.

Tower Hill (2).—J. Alstone and J. Thompson.

Unattached (22).—L. Atkinson, Mrs. Blow, E. Collingwood, H. Cooper, R. E. Crossland, G. Dannatt, F. Enoch, W. H. Fairbank, J. Fitz Marshall, J. J. Gaccad, J. J. Gibson, H. Hills, G. Lovell, J. Marshall, senr., F. W. Peet, W. J. Richardson, G. H. Rodman, C. D. Sherborn, J. H. Stanley, C. W. Stidstone, J. A. Williams, and J. R. Williams.

Croydon Microscopical and Natural History Club.—Balance Sheet for the Year ending 31st December, 1889.

Receipts.	£	s.	d.	£	s.	d.
Balance, 1st January, 1889... ...				32	10	7
Subscriptions for the year 1887 ...	2	0	0			
" " " 1888 ...	12	10	0			
" " " 1889 ...	113	0	0			
" " " 1890 ...	3	10	0			
" " " 1891 ...	0	10	0			
				131	10	0
Sale of Soirée Tickets				14	17	6
Sale of Transactions...				0	7	0
				£179	5	1

Expenditure.	£	s.	d.
Rent of Club Room	10	0	0
Hire of Rooms for Meetings	6	0	6
Printing and Stationery	15	3	0
Bookbinding		15	6
Printing Transactions	22	9	1
Postages (including Transactions)	16	5	9
Soirée Expenses, 1889	53	5	8
" " 1888	7	11	0
Meteorological Sub-Committee	19	14	3
Geological Sub-Committee	0	8	0
Botanical Sub-Committee	2	0	0
Attendance, and Collecting Subscriptions ...	8	2	0
Portrait of Henry Lee for Club Room	2	15	0
Sundries	5	9	8
Balance, 31st December, 1889	9	5	8
	£179	5	1

SPECIAL FUND.

Receipts	£	s.	d.
Balance, 1st January, 1889	38	16	2
Dividends on 2¾ per cent. Stock	5	18	2
	£44	14	4

Expenditure	£	s.	d.
Optical Lantern and Lenses, complete ...	13	10	3
Two Steel Gas Bottles: Screen and Stand ...	5	9	0
Balance 31st December, 1889	25	15	1
	£44	14	4

	£	s.	d.
Balance at Banker's, 31st December, 1889 ...	£35	0	9
Invested in 2¾ per cent. Consolidated Stock	£210	11	8

KENNETH McKEAN, *Treasurer.*

We, the undersigned, having examined the above Accounts and the Vouchers relating thereto, hereby certify that they are correct, according to the Vouchers and the Banker's Pass Book.

W. J. ALLBRIGHT,
HARRY D. GOWER, } *Auditors.*

January 6th, 1890.

CATALOGUE OF MICROSCOPICAL PREPARATIONS IN THE CABINET OF THE CROYDON MICROSCOPICAL AND NATURAL HISTORY CLUB. 1890.

In the following Catalogue but little attempt has been made at scientific classification, but in order to facilitate the introduction of new slides, and the withdrawal of spoiled ones, the Collection has been divided into 25 sections, corresponding with the letters of the alphabet; therefore in applying for slides members must be careful to give the Letters, as well as the Numbers, of the Slides they require.

INDEX.

VEGETABLE KINGDOM.

Section A—Diatomaceæ.

1.	Arachnoidiscus Ehrenbergii	Cole
2.	Cestodiscus superbus	"
3.	Grammatophora marina & Rhabdonema arcuatum	Ed. Lovett
4.	Ooze from Antarctic Ocean (H.M.S. 'Challenger')	"
5.	" "	W. M. Holmes
6.	Bacteriastrum (Arafura Sea) H.M.S. 'Challenger'	"
7.	Diatoms (H. M. S. 'Egeria')	"
8.	" "	"
9.	Campylodiscus (Simmering, Saxony)	"
10.	Cementstein (Mors Island, Jutland)	"
11.	Diatoms (Richmond, Virginia)	"
12.	" (Nottingham, Maryland)	"
13.	" (Richmond, Virginia)	"
14.	" from Guano	"
15.	" "	Ph. Crowley

Section B—Algæ (Marine and Fresh-water).

1.	Plocamium coccineum	W. L. Sarjeant
2.	Fresh-water Conferva	K. McKean
3.	"	"
4.	The growth of Marine Conferva (*in situ*) No. 1	"
5.	" " No. 2	"
6.	" " No. 3	"

These slides Nos. 1, 2 and 3, were suspended in a marine aquarium shaded from the rays of the sun. No. 1 was mounted after 14 days' immersion (or as soon as bubbles of oxygen appeared on its surface), No. 2 a week later, and No. 3 a week after that.

Section C—Fungi, Ferns and Mosses.

1.	Polytrichum (Antheridia)	Cole
2.	Funaria hygrometrica	John Berney
3.	Æcidium epilobii	Ed. Lovett
4.	Davallia Tyermanni (Scales)	J. Gregory
5.	Hymenophyllum Tunbridgense	Ph. Crowley
6.	Platycerium Alcicorne	John Berney
7.	Hymenophyllum Tunbridgense	Ph. Crowley
8.	Adiantum capillus-veneris	K. McKean
9.	Davallia elegans	"
10.	Polypodium vulgare	"
11.	Polystichum aculeatum	"
12.	Scolopendrium vulgare	"
13.	" (vert. sect. of Sorus) ...	Cole
14.	Asplenium adiantioides	K. McKean
15.	Aspidium Filix-mas	"

Section D—Cuticles, Hairs and Raphides.

1. Cactus (Spines)	Ed. Lovett
2. Aloe (Cuticle, dry, to show cells)	„
3. „ „ (stained)	W. H. Beeby
4. Echinocactus Visnaga (Raphides)	J. Gregory
5. Poplar seed (Hairs)	W. M. Holmes
6. Cowhage (Mucuna pruriens), Hairs from Fruit	„
7. Hippophae rhamnoides (Scales from Leaf, dry)	K. McKean
8. „ „ Polariscope	„
9. Rhododendron Maddenii (Scales from under side of Leaf)	J. Gregory
10. Shepherdia argentea (Scales from Leaf)	K. McKean
11. Mercurialis perennis (Sphæraphides and spiral fibres from Leaf)	W. H. Beeby
12. Tamus communis (Expressed Juice of Berry) ...	„

Section E—Pollen, Starch and Seeds.

1. Tobacco Plant (Pollen)	K. McKean
2. Passiflora cærulea (Pollen)	Ed. Lovett
3. Catalpa syringæfolia (Pollen)	„
4. Tradescantia virginica (Anthers and Pollen) ...	W. L. Sarjeant
5. Lilium bulbiferum (Pollen)	Ed. Lovett
6. Spermania (Stamens)	Ph. Crowley
7. Tacca (Starch)	J. H. Baldock
8. Rice („)	„
9. Maize („)	„
10. Potato („)	K. McKean
11. Arum maculatum (Starch)	J. H. Baldock
12. Oat (Starch)	„
13. Potato (Starch)	„
14. Barley „	„
15. Acorn „	„
16. Chestnut (Starch)	„
17. Tous les Mois (Starch)	„
18. Orris Root (Starch)	„
19. Silene inflata (Seeds)	K. McKean
20. Lobelia inflata („)	W. M. Holmes
21. Nemesia elegans (Seeds)	„
22. Pantoronia imperialis (Seeds)	K. McKean
23. Hypericum perforatum (Seeds)	Ed. Lovett
24. Poppy from Delhi (Seeds)	„
25. Ice Plant (Seeds)	„
26. Blumenbachia coronata (Seeds)	J. Gregory
27. Chara (Fossil Seeds)	W. M. Holmes

Section F—Leaves and Petals, &c.

1. Trifolium procumbens (Leaflet)	W. H. Beeby
2. „ arvense (Leaflet)	„
3. „ Molinerii (Stipule)	„
4. „ „ (part of Calyx)	„
5. „ „ (Leaflet)	„

6.	Vicia Bobartii (Leaflet)	W. H. Beeby
7.	Medicago lupulina (Leaflet)	,,
8.	Geranium molle (Sepal)	,,
9.	Polygonum (part of Leaf)	,,
10.	Epilobium montanum (part of Leaf)	,,
11.	Lathyrus pratensis (Stipule)	,,
12.	Geranium pusillum (Sepal)	,,
13.	Orobus tuberosus (part of Leaflet)	,,
14.	Mercurialis perennis (part of Leaf)	,,
15.	Typha latifolia (trans. sect. of Leaf)	,,
16.	Orchis mascula (part of Leaf)	,,
17.	Shepherdia argentea (Leaf, opaque)	K. McKean
18.	Potamogeton oblongus (part of Leaf)	W. H. Beeby
19.	Deutzia scabra (Leaf, opaque)	K. McKean
20.	Ficus elastica (Mid-rib from Leaf)	W. L. Sarjeant
21.	,, (sect. of Leaf)	W. M. Holmes
22.	Eleagnus speciosa (Leaf)	K. McKean
23.	Correa speciosa (Petal)	John Berney
24.	Hippophae rhamnoides (Leaf)	K. McKean
25.	Trichinium Marylesii (Floret)	J. Gregory
26.	Oak Button	

Section G—Sections (Botanical).

1.	Rubus fruticosus (trans. sect of Stem)	W. H. Beeby
2.	Sparganium simplex (long. sect. of Stem) ...	,,
3.	,, (trans. sect. of Stem) ...	,,
4.	Rush (sect. of Stem)	J. S. Johnson
5.	Phytolacca decandra (trans. sect. of Stem) ...	Ed. Lovett
6.	Cobæa scandens (trans. sect. of Stem)	W. L. Sarjeant
7.	Laburnum (sect. of Root)	John Berney
8.	Brazil Nut (sect. of Shell)	Ph. Crowley
9.	Quillaia Bark (section)	Ed. Lovett
10.	Artemisia Absinthium (trans. sect. of Stem) ...	,,
11.	Cedar (sect. of Wood)	,,
12.	Elder (sect. of Pith)	,,
13.	Cinchona calisaya (sect. of Bark)	W. M. Holmes
14.	,, succirubra (sect. of Bark)	,,
15.	,, Condaminea (sect. of Bark)	,,
16.	Cane (trans. section)	,,
17.	Rush ,, ...	,,
18.	Sarsaparilla (trans. sect. of Root)	,,
19.	Acer pseudo-platanus (trans. sect. of Twig) ...	,,
20.	Clematis vitalba (trans. sect. of Twig)	,,
21.	Brake (Pteris aquilina), trans. sect. of Stem ...	,,
22.	Cork (section)	K. McKean
23.	Philanthus mimosæfolia (trans. sect. of Stem) ...	W. H. Beeby
24.	Straw (Ash from)	W. M. Holmes
25.	Palm (Prichardia pacifica), sect. of Leaf-stem ...	Ed. Lovett

ANIMAL KINGDOM.

Section H—Sponges.

1. Halichondria (trans. section) ... ... Cole
2. Euplectella aspergillum (Spicules) ... ... K. McKean
3. Geodia Barrettii (Spicules) ... ... W. M. Holmes
4. Dredging (H.M.S. 'Egeria') ... ... „
5. Spicules from a Flint (Horstead, Norfolk) ... G. J. Hinde
6. Donatia robusta (Spicules) ... ... W. M. Holmes
7. Various Spicules ... ... „

Section J—Foraminifera.

1. Nummulites. Eocene: Isle of Wight ... ... Ed. Lovett
2. „ „ Portsmouth ... ... „
3. Dredgings, H.M.S. 'Porcupine,' 2435 fathoms ... K. McKean
4. „ „ ... „
5. „ H.M.S. 'Challenger,' Deep-sea ... Ed. Lovett
6. Foraminifera from Sponge ... ... J. S. Johnson
7. „ „ ... ... K. McKean
8. „ from Chalk, Warlingham ... ... „
9. „ „ ... ... „
10. „ from Sponge Sand ... ... W. L. Sarjeant
11. „ „ Chalk, Croydon ... ... „
12. Calcarina, Ceylon ... ... W. M. Holmes
13. Globigerina (Ooze), Atlantic, H.M.S. 'Challenger' Cole
14. Foraminifera from Chalk, Margate ... ... K. McKean
15. „ „ Sponge Sand ... ... W. M. Holmes
16. „ Internal Casts, Macassar Straits ... „

Section K—Polycystina.

1. Polycystina, Chalky Mount, Barbadoes ... ... W. M. Holmes
2. „ „ ... ... „
3. „ Opaque ... ... J. S. Johnson
4. „ ... ... „
5. „ ... ... W. L. Sarjeant
6. „ Springfield, Barbadoes ... ... Cole
7. „ H. M. S. 'Challenger' ... ... W. M. Holmes
8. „ Barbadoes ... ... „

Section L—Zoophytes (Polyzoa, Hydrozoa, &c.).

1. Cristatella mucedo (Ova) ... ... Ed. Lovett
2. Anguinaria spatulata (parasitic on an Alga) ... „
3. Gorgonia (Spicules), South Africa ... ... W. L. Sarjeant
4. Bugula avicularia and Campanularia ... ... W. M. Holmes

Section M—Echinodermata.

1.	Star Fish (Palinipes membranaceus), Spines and Plates	Cole
2.	Green Pea Echinus	Ed. Lovett
3.	Echinus (Spines of young)	K. McKean
4.	,, (basal portion of Spine)	Ed. Lovett
5.	Cidaris (sections of Spine)	W. M. Holmes

Section N—Mollusca.

1.	Anodonta cygnæa (horizontal sect. of Gill) ...	Cole
2.	,, (trans. sect. of Gill with Glochidia *in situ*)	,,
3.	Anodonta cygnæa (trans. sect. Organ of Bojanus)	,,
4.	,, (trans. sect. Genital Gland) ...	,,
5.	,, (portion of Mantle showing the Shell-secreting margin)	K. McKean
6.	Anodonta cygnæa (Adductor Muscle skeined fibres)	,,
7.	Helix pomatia (Roman Snail), trans. sect. of Ovitestis	Cole
8.	Helix pomatia (Palate)	W. L. Sarjeant
9.	Cyclostoma elegans (Odontophore)	Cole
10.	Limnæus pereger (Odontophore)	K. McKean
11.	Anodonta cygnæa (Embryo)	,,
12.	,, (young)	W. L. Sarjeant
13.	Octopus vulgaris (Skin)	K. McKean
14.	Planorbis. Eocene: Hadon Hill, Isle of Wight	Ed. Lovett
15.	,, ,, London Clay, Sheppey ...	,,

Section O—Crustacea.

1.	Cyclops quadricornis	K. McKean
2.	Lobster (trans. sect. of Liver)	Cole

Section P—Arachnida and Myriapoda.

1.	Epeira diadema (Foot)	Cole
2.	,, (Spinneret)	,,
3.	,, (Jaws)	,,
4.	,, (Leg)	K. McKean
5.	Tick of Blatta orientalis	Ed. Lovett
6.	Parasite of Golden Eagle	,,
7.	Lipecurus of Pheasant	,,
8.	Parasite of Pheasant (Ova)	,,
9.	,, Indian Kite	K. McKean
10.	,, Dung Beetle	,,
11.	Crab Louse (Phthirius pubis), human	,,
12.	Tick of Pariah Dog, Madras	,,
13.	Stone Mite (Ova)	John Berney
14.	Centipede	,,
15.	,, ...	,,
16.	,, (Head)	K. McKean

Section Q—Annulosa.

1.	Earth Worm (Lumbricus terrestris), trans. sect.	Cole
2.	„ „ Spermatozoa	„
3.	„ „ young ...	K. McKean
4.	Tape-worm, human (Tœnia mediocanellata), long. vert. sect. through middle region ...	Cole
5.	Trichina spiralis (encysted in Muscle)	„
6.	Ascaris vermicularis (Thread-worm, human) ...	K. McKean
7.	Leech (Sanguisuga medicinalis), trans. section	Cole
8.	Liver Fluke (Fasciola hepaticum), trans. section between Suckers	„
9.	Liver Fluke (Sheep)	J. S. Johnson

Section R—Insects (Whole).

1.	Termite Worker (Termes bellicosus), Madras ...	K. McKean
2.	Thrips from ear of Wheat	„
3.	„	„
4.	Aphis rosæ stung by Ophion luteum	Ed. Lovett
5.	Larva of ?	John Berney
6.	„	„
7.	Flea of Dog (Pulex canis)	K. McKean
8.	Notonecta glauca (Boatman Fly, 4 days old) ...	„

Section S—Insects (Parts).

1.	Gnat (Culex pipiens), Legs	K. McKean
2.	Ichneumon Fly (Legs)	„
3.	Notonecta glauca (Hind Leg)	J. S. Johnson
4.	Blow Fly (Musca vomitoria), Foot	K. McKean
5.	House Fly (Musca domestica), Foot	„
6.	Tiger Mosquito (Head, Wings and Legs) ...	„
7.	Blue-bottle Fly (Eyes)	„
8.	Ichneumon Fly (Sting)	„
9.	Humble Bee (Sting)	„
10.	Sawfly (Head)	„
11.	„ (Ovipositors separate)	„
12.	„ (Ovipositors in natural position) ...	„
13.	Boarmia rhomboidaria (Antenna and Leg) ...	Ed. Lovett
14.	Ichneumon Fly (Antenna)	K. McKean
15.	White Moth (Antenna)	„
16.	Crane Fly (Tipula oleracea), Head	Cole
17.	Tiger Mosquito (Head), Madras	K. McKean
18.	White Moth (Eyes)	„
19.	Moth (Tongue)	„
20.	Silkworm (Tracheal System)	Cole
21.	Ichneumon Fly (Wing)	K. McKean
22.	Ladybird (Coccinella), Wing	„
23.	Blue-bottle (Musca vomitoria), Wing	„
24.	Dermestes (Exuvium of Larva)	W. M. Holmes
25.	Puss Moth (Cerura vinula) and appendage of Larva	Ed. Lovett

26. Goat Moth (Cossus ligniperda), Proleg of Larva	J. S. Johnson
27. Swallow-tail Moth (Ourapteryx sambucata), Ova	John Berney
28. Fly (Ova)	"
29. Waved Umber Moth (Ova)	"

Section T—Wings and Scales of Lepidoptera, Coleoptera, &c.

1. Tropical Lepidoptera (upper surface of Upper Wing)	Ed. Lovett
2. Tropical Lepidoptera (upper surface of Upper Wing)	"
3. Tropical Lepidoptera (lower surface of Upper Wing)	"
4. Tropical Lepidoptera (lower surface of Lower Wing)	"
5. Tropical Lepidoptera (upper surface of Upper Wing)	"
6. Tropical Lepidoptera (upper surface of Upper Wing)	"
7. Polyommatus Corydon (Scales)	W. L. Sarjeant

Section U—Fish-skin, Scales, &c.

1. Gobius (Skin)	J. S. Johnson
2. Eel (Skin)	"
3. "	K. McKean
4. Eel (Scales)	Ph. Crowley
5. "	"
6. Sole (Skin)	J. S. Johnson
7. " (Scale)	"
8. " "	Ph. Crowley
9. Sword Fish (Scales from Rostrum)	Ed. Lovett

Section V—Hairs and Feathers (Vertebrate).

1. Feather in its Follicle (section)	Cole
2. Peccari (Dycotyles Tajaca), trans. sect. of Hair	"
3. Porcupine (Hystrix cristata), trans. sect. of Quill	Ph. Crowley
4. " " of Quill stained	W. L. Sarjeant
5. Porcupine (Hystrix cristata), trans. sect. of Quill stained	Ph. Crowley
6. Hedgehog (Erinaceus europæus), trans. sect. of Spine	W. M. Holmes
7. Rhinoceros (trans. sect. of Hair from Tail) ...	"
8. " " ...	"
9. Diseased Hair (human)	K. McKean
10. Ornithorhynchus paradoxus (Hair)	W. M. Holmes
11. Kangaroo (Hair)	Ed. Lovett

Section W—Sections of Teeth, Bone, Horn, &c.

1.	Human Bone (trans. sect. of compact tissue of shaft of long Bone)	Cole
2.	Greenland Whale (Balæna mysticetus), sect. of Baleen	Ed. Lovett
3.	Bullock's Hoof (section)	W. M. Holmes
4.	Red Deer (Cervus elaphus), sect. of Antler (Fossil)	Ph. Crowley
5.	Fallow Deer (Dama platyceros), sect. of Antler	,,
6.	Human Corn (section)	J. S. Johnson

Section X—Anatomical Preparations (Vertebrate).

1.	Lung, human (vert. section)	Cole
2.	Kidney, human (trans. section)	K. McKean
3.	Lung (Alveolar Pneumonia), 1st stage	Cole
4.	,, ,, 2nd stage	,,
5.	,, ,, 3rd stage	,,
6.	,, Broncho-Pneumonia	,,
7.	,, Interstitial Pneumonia	,,
8.	,, Acute Pleurisy	,,
9.	,, Tuberculosis	,,
10.	,, Tubercular Phthisis (Tubercle softening in centre)	,,
11.	Lung, Brown Induration	,,
12.	,, Anthracosis	,,
13.	,, Vesicular Emphisema	,,
14.	,, Carcinoma	,,
15.	Kidney, human (vert. section injected)	,,
16.	,, ,, (stained)	,,
17.	,, ,, (Infant)	,,
18.	,, ,, (Fœtus at term)	,,
19.	,, Interstitial Nephritis (waxy disease) ...	,,
20.	,, ,, ...	,,
21.	,, Large white (early stage)	,,
22.	,, ,, (later stage)	,,
23.	,, in Leucocythæmia	,,
24.	,, Acute Congestion	,,
25.	,, Fatty Degeneration (phosphorus poisoning)	,,
26.	,, Secondary Epithelioma	,,
27.	,, Tubercular Renal Phthisis	,,
28.	,, Red Granular	,,
29.	Pancreas, human (trans. sect. injected)	,,
30.	,, (trans. sect. stained)	,,
31.	Thyroid Gland, human (trans. section)	,,
32.	Spleen, human (vert. section)	,,
33.	Liver, human (to show hepatic cells)	,,
34.	Areolar Tissue, human (stained)	,,
35.	Adipose Tissue, human (stained)	,,
36.	Nerve Tissue, human (trans. section)	,,
37.	Hyaline Cartilage (Human Trachea)	,,

38.	Epithelium 1, Squamous (Tongue)	Cole
	,, 2, Columnar (Intestine)	,,
	,, 3, Ciliated (Fauces)	,,
39.	Cerebellum, human (trans. sect. stained) ...	,,
40.	Cerebrum, human ,, ...	,,
41.	Skin, human (vert. sect. of Sole of Foot) ...	,,
42.	Scalp, ,, (horizontal sect. double stained) ...	,,
43.	,, ,, (vertical section double stained) ...	,,
44.	Penis, human, Infant at term (section)	,,
45.	Cat, Ileum (trans. sect. injected)	,,
46.	,, Spleen ,, ...	,,
47.	Ossification of Cartilage (long. sect. of Femur of Kitten)	,,
48.	Cat, Spinal Cord (Dorsal region)	,,
49.	,, Cornea (vert. section)	,,
50.	,, Lung (injected)	,,
51.	,, Testis (trans. section)	,,
52.	,, Mammary Gland during period of lactation (trans. section)	,,
53.	Kitten, Ovary (trans. section)	,,
54.	Cat, Liver (injected)	,,
55.	Dog, Submaxillary Gland (vert. section) ...	,,
56.	,, Tongue (vert. section)	,,
57.	,, ,, (vert. trans. section)	,,
58.	,, Large Intestine (trans. section)	,,
59.	,, Stomach (trans. sect. Pyloric end)	,,
60.	,, Tail of Puppy (trans. section)	,,
61.	,, Penis of Puppy 1 month old (trans. section)	,,
62.	,, Duodenum (trans. section)	,,
63.	,, Stomach (trans. sect. Cardiac end) ...	,,
64.	,, Œsophagus (trans. section)	,,
65.	Calf, Thymus Gland (hor. section)	,,
66.	Cow, Yellow fibro-cartilage from Pinna of Ear ...	,,
67.	Sheep, Lung (trans. sect. of Bronchus)	,,
68.	,, Kidney (hor. sect. of Papillary portion) ...	,,
69.	Lamb, Tendon (trans. section)	,,
70.	Rabbit, Uterus ,, ...	,,
71.	Rhinoceros, Ligamentum Nuchæ (section) ...	Ed. Lovett
72.	Elephant, Indian (flesh of Foot, section) ...	,,
73.	Mouse, Liver and Kidney (sections)	W. M. Holmes
74.	Rat (Spermatozoa)	Cole
75.	Pig (Muscle)	,,
76.	Duck (trans. sect. of Lung)	,,
77.	Bird (trans. sect. of Ovary)	,,
78.	Tadpole (Mouth)	,,
79.	Frog (trans. sect. of Lung)	,,
80.	,, (vert. sect. of Skin, stained)...	,,
81.	,, Blood (double stained)	,,
82.	Lamprey (trans. section)	,,
83.	Water Snake (Blood discs), Madras	K. McKean
84.	Carpet Snake (Morelia variegata), Blood discs, Madras	,,
85.	Carpet Snake (Muscular fibre)	,,
86.	,, ,, ...	,,

MINERAL KINGDOM.

Section Y—Minerals and Crystals.

1.	Pikrite, Inchcolm, Frith of Forth	Cole
2.	White Syenite, Lain	"
3.	Red Syenite, Ord Hill, Sutherland	"
4.	Oolite (Secondary Formation)	Norman
5.	" "	"
6.	Porphyritic Basalt, Edinburgh	Cole
7.	Serpentine, Portsoy	"
8.	" The Lizard, Cornwall	"
9.	Hebridian Gneiss, Hannan Islands	"
10.	Dolerite, Dalmahoy Hill	"
11.	Diabase, Corstorphine Hill, Edinburgh ...	"
12.	Uric Acid (Natural Crystals)	W. M. Holmes

Section Z—Miscellaneous.

1.	Mummy-cloth from Luxor	Ed. Lovett

LIST OF MEMBERS.

Revised to end of March, 1890.

Date of Election.	
12 Oct. 1887.	ADAMS, WALTER, Trevenna House, Chepstow-road.
13 Mar. 1889.	ALDOUS, THOMAS DUNCAN, 37 St. Peter's-road.
10 Oct. 1883.	ALDRIDGE, WILLIAM, Westow-st., Uppr. Norwood, S.E.
10 Dec. 1884.	ALLBRIGHT, W. J., Broad-green, Croydon.
9 Mar. 1887.	ALLDER, JOSHUA. 2 The Close, Chatsworth-road.
13 May, 1885.	ALLEN, FRANK, Warrington House, Duppas Hill-road.
9 Aprl. 1884.	ALLEN, A. H., Melrose Villa, Wellesley-road.
11 May, 1887.	AUSTEN, W. V., 18 Belgrave-rd., South Norwood, S.E.
19 Mar. 1879.	BACKWELL, RICHARD, Tennison-rd., S. Norwood, S.E.
9 Jan. 1889.	BACKWELL, WILLIAM EDGAR, 1 Tennison-road, South Norwood, S.E.
21 Mar. 1877.	BADDELEY, T., The Chestnuts, Broad Green.
19 Nov. 1873.	BAILEY, EDWIN, Lansdowne-road.
4 May, 1870.	BAKER, SAMUEL, Lansdowne-road.
Original.	BALDISTON, FREDERICK, Glastonbury Lodge, Sydenham-road.
15 Aprl. 1874.	BALDOCK, J. H., F.C.S., 3 High-st., S. Norwood, S.E.
9 Sept. 1885.	BARBER, J. H., 41 London-road.
10 Nov. 1886.	BARRITT, F. ALFRED, Hazeleigh, Dean-road.
14 Aprl. 1886.	BARROW, REUBEN VINCENT, Engadine, Park Hill Rd.
8 Feb. 1888.	BASTARD, EDWARD ROGER, Highbury House, South Norwood, S.E.
10 Mar. 1886.	BAYARD, F. CAMPBELL, LL.M., F.R. Met. Soc., Manor-road, Wallington.
14 Mar. 1888.	BEARD, DR. F., Westwood, Brighton-road.
15 Mar. 1871.	BEEBY, WILLIAM H., F.R.M.S., 14 Ridinghouse-street, London, W.
11 Nov. 1885.	BERNEY, HENRY, 114 North End.
Original.	BERNEY, JOHN, F.R.M.S., 114 North End.
13 Jan. 1886.	BINYON, THOMAS W., Chichester-road.
9 Oct. 1889.	BLACKETT, A. STUART, Bloomsbury Mansion, Hart-street, London, W.
Original.	BLAKE, W. J., Elmfield, Park-lane.
10 Aprl. 1889.	BLOW, EDGAR F., 110 Lower Addiscombe-road.
10 Dec. 1884.	BREBNER, G. REITH, M.D., Bensham Lodge, West Croydon.
15 Dec. 1880.	BREWER. J. G. B., Havelock-road.
11 Apl. 1888.	BROCK, ARTHUR, Chagford, Selhurst-rd., S. Norwood.
16 Jan. 1878.	BROCK, GEO. E., Beech Hyrst, Haling Park Road.
19 Feb. 1873.	BRODIE, ROBERT, M.A., George-street.
9 Mar. 1887.	BROOKS, W., Laurel Villa, Wray Park, Reigate.
10 Nov. 1886.	BROWN, J. WEIR, Ferndean, Heathfield-road.
12 Nov. 1884.	BUCKLAND, JOHN WELLINGTON, 130 Lower Addiscombe-road.

Date of Election.	
19 Jan. 1881.	Budd, Percy, High-street.
12 Mar. 1890.	Budgen, Walter, Elswick Villa, Addiscombe-road.
9 Jan. 1889.	Bullock, William R., 20 Dingwall-road.
14 Mar. 1888.	Burrough, F., Trellis Cottage, Collier's Water Lane, Thornton Heath.
21 Mar. 1877.	Carpenter, A. B., B.A., M.R.C.S., F.R.M.S., Bedford Park.
Original.	Carpenter, Alfred, M.D., J.P., Heath Lodge, Lower Addiscombe-road.
19 Jan. 1881.	Carter, James A., M.A., Reedham, Purley, Surrey.
11 Jan. 1888.	Cash, William, Jun., Lifford Lodge, Outram-road.
15 Jan. 1874.	Chambers, W. E,. J.P., Eversfield, Sutton.
11 Aprl. 1888.	Chatterton, George, M.A., M. Inst. C.E., Linton, Grosvenor Hill, Wimbledon, S.W.
15 Dec. 1880.	Cheeswright, F. R., Maythorne, Birdhurst Rise.
16 May, 1877.	Chisholm, Jas., 21 Outram-road.
19 Aprl. 1876.	Chumley, John, Worcester Lodge, Canning-road.
16 May, 1877.	Clarke, Josiah, 88 George-street.
20 Dec. 1876.	Coates, W. N., Fairfield-road.
12 Dec. 1888.	Courlander, Louis, 42 North End.
18 Jan. 1882.	Collyer, Henry C., Beecholm, Park Hill Road.
21 Oct. 1887.	Collyer, Bryce, Woodlands, Haling Park Road.
Original.	Corden, George, F.R. Met. Soc., 33 Limes-road.
16 Aprl. 1873.	Corry, John, J.P., Rosenheim, Park Hill Road.
14 Dec. 1887.	Couchman, Alfred, Houghton, Birdhurst Rise.
21 May, 1879.	Cowdell, H. S., Cotleigh, West Wickham, Beckenham.
11 Nov. 1885.	Crosfield, G. T., Hurstleigh, South Park Hill Road.
10 Oct. 1888.	Crossman, Henry Danvers, Shirley, Surrey.
Original.	Crowley, Philip, F.Z.S., Waddon House.
9 Jan. 1889.	Crowley, Ralph Henry, Bramley Oaks, Bramley Hill.
20 May, 1886.	Cullis, William Henry, 7 Gresham-road, South Norwood, S.E.
20 May, 1874.	Curling, George, Elgin House, Addiscombe-road.
Original.	Cushing, Thomas, F.R.A.S., 2 Southside, Chepstow-road.
18 Aprl. 1877.	Davies, Arthur Capel, The Glen, Duppas Hill.
15 Sept. 1875.	Dickinson, William, M.A., F.G.S., Warham-road.
9 Jan. 1889.	Distant, William Lucas, F.G.S., Russell Hill Road, Purley.
8 Aprl. 1885.	Dixon, John, C. E., High Towers, Selbourne-road, Park Hill.
Original.	Dix, T. H., 81 High-street.
11 May, 1887.	Down, H. W., Bank Chambers, North End.
9 Jan. 1884.	Drage, John Henry, Tamworth-road.
18 Sept. 1888.	Drage, John, Tamworth-road.
19 Dec. 1877.	Drummond, H., 6 Walpole-road.
18 Feb. 1880.	Dukes, M. Charles, M.D., Wellesley-road.
18 May, 1887.	Duncan, Peter Thomas, M.D., Park-lane.
14 Sept. 1887.	East, Frederick W. Timberham, Horley, Surrey.
18 Nov. 1874.	Eastty, Alfred, Addiscombe-road.

Date of Election.	
16 Aprl. 1879.	Eaton, H. S., M.A., F.R., Met. Soc., Shepton Montague, Castle Cary, Somerset.
4 May, 1870.	Edridge, Sir Thos. R., J.P., The Elms, High-street.
9 Dec. 1885.	Elborough, C. M., Hazlehurst, Park Hill Road.
19 Jan. 1881.	Epps, James, Jun., The Homestead, Ross-road, South Norwood, S.E.
21 Feb. 1872.	Fagg, Edward, Beachley, Chichester-road.
9 Jan. 1884.	Falk, Ferdinand, 1 Park Hill Road.
1883.	Fenn, W. G., Heath Lodge, Thornton Heath, S.E.
8 Feb. 1888.	Gaster, Frederick, F.R. Met. Soc., 137 Acre Lane, Brixton, S.W.
13 Mar. 1889.	Gibb, James, 18 Outram-road.
Original.	Gibson, John, 10 Canning-road.
19 Oct. 1881.	Gibson, Walter M., 1a Lower Grosvenor-place, S.W.
11 Mar. 1885.	Gill, J. J., 179 St. James's-road.
9 Nov. 1887.	Glazier, J. T., Mavis Bank, Park Hill Rise.
13 Mar. 1889.	Goddard, D. Everett, F.R.M.S., Wallington.
9 Feb. 1887.	Goodman, C. H. 9 Dorlcote-rd, Wandsworth Common, S.W.
14 Jan. 1885.	Gower, Harry Douglas, 16 Wandle-Road.
12 Jan. 1887.	Greenway, Henry, Ulimbali, Ashburton-road.
12 Jan. 1887.	Green, J. S., Ranmore, Birdhurst Rise.
11 Nov. 1885.	Gripper, Dr. Walter, Wallington, Surrey.
8 Aprl. 1885.	Grundy, Richard F., Melton Lodge, Havelock-road.
18 Jan. 1882.	Guimaraens, P. G., Warham-road.
12 Dec. 1883.	Gurney, George, Canning-road.
Original.	Haddock, Roland, 5 The Waldrons.
9 Jan. 1889.	Hall, Thomas William, 7 Princess-rd., Selhurst, S.E.
18 May, 1881.	Hart, P., "Lyndhurst," Fairfield-road.
19 Mar. 1879.	Harwood, W. R., Glebelands, Mitcham.
14 Mar. 1888.	Helps, James W., Waddon Marsh-lane, Surrey.
19 Sept. 1877.	Henman, Charles, "Streatley," Friend's-road, East.
10 Nov. 1886.	Herbert, Honourable Sydney, M.P., 10 Mandeville-place, Manchester-square, W.
12 Jan. 1887.	Hinde, Dr. George J., F.G.S., Avondale-road.
21 Sept. 1881.	Hobson, J. M., M.D., 65 Lower Addiscombe-road.
12 May, 1886.	Holmes, W. Murton, Glenside, St. Peter's-road.
15 Jan. 1890.	Hopewell, M., 79 Lansdowne Gardens.
Original.	Horsley, Henry, M.R.C.S., London-road.
11 Aprl. 1888.	Hovenden, A. Cecil, Arbor End, Selhurst-rd., South Norwood, S.E.
11 Aprl. 1888.	Hovenden, Ernest C., Arbor End, Selhurst-rd., South Norwood, S.E.
11 Aprl. 1888.	Hovenden, G. S., Arbor End, Selhurst-road, South Norwood, S.E.
16 Feb. 1881.	Hovenden, R. G., Heathcote, Park Hill Road.
2 Mar. 1873.	Hovenden, T., Arbor End, Selhurst-road, South Norwood, S.E.
14 Aprl. 1886.	Howell, Albert D., St. Andrews, Perryvale, Forest Hill, S.E.

Date of Election.	
18 Jan. 1882.	HUDDLESTON, Rev. GEORGE HENRY, 106 St. James-road.
11 Mar. 1885.	HUGHES, MORGAN, 4 Wellesley-road.
17 May, 1871.	INGRAMS, WILLIAM, Whitgift Schools, Church-road.
12 Mar. 1890.	I'ANSON, WILLIAM HENRY, 120 St. James-road.
16 Dec. 1874.	JARRETT, C., 30 St. John's Grove.
9 Mar. 1887.	JOHNSTON, B. McKAY, Katharine-street.
Original.	JONES, E. F., 34 Eastcheap, London, E.C.
18 Jan. 1882.	JONES, SAMUEL, Trelawney, Addiscombe-road.
16 Feb. 1881.	JUSTICAN, J. W., B.A., Outram-road.
8 Feb. 1888.	KING, CHARLES, Station-road, South Norwood, S.E.
14 Nov. 1888.	KLAASSEN, H. M., Aberfeldy, Campden-road.
10 Jan. 1883.	KÜSTER, GUSTAV, 14 Dingwall-road.
21 Nov. 1877.	LAING, R. A., St. Peter's-road.
21 Dec. 1876.	LAMBERT, A., Jun., Mersey View, Cressington Park, near Liverpool.
18 Aprl. 1877.	LANE, HARRY, Havelock-road.
8 Aprl. 1885.	LANFEAR, CECIL, Rockwood, Chichester-road.
Original.	LATHAM, BALDWIN, C. E., 21 Havelock-road.
Original.	LEE, HARRY, 20 St. John's-grove.
16 May, 1877.	LEE, J. R., 70 High-street.
11 Oct. 1882.	LERÉSCHE, GEORGE HENRY, 3 Alexandra-road.
14 Aprl. 1886.	LINTON, FRANCIS J. G., Clydesdale, Park Hill Road.
8 Oct. 1876.	LOFTUS, T., Outram House, Lower Addiscombe-road.
Original.	LONG, HENRY, 132 High-street.
18 Feb. 1874.	LOVETT, EDWARD, West Burton House, Outram-road.
12 Mar. 1890.	LOVETT, WALTER JAMES, Linda Villa, Farquharson-road.
10 Aprl. 1889.	MAIDLOW, WM. HENRY, Elm Lodge, Park Hill Rise.
Original.	MAJOR, CHARLES M., Duppas Hill Terrace.
13 Mar. 1889.	MANSFIELD, CHARLES, The Lindens, Coombe-road.
15 Dec. 1880.	MARKS, J. G., 115 Waddon New-road.
Original.	MARSHALL, EDWARD, M.R.C.S., Church House, Mitcham.
10 Mar. 1886.	MARSHALL, ROBERT, Broomfield, The Avenue, Duppas Hill.
8 May, 1889.	MARTIN, HOWARD, Bolney Grange, Havelock-road.
20 Feb. 1878.	MATHER, C. W., 47 Dingwall-road.
9 Feb. 1887.	MAW, G., F.R.S., F.L.S., Benthall, Kenley, Surrey.
11 Aprl. 1888.	MAYER, GEORGE, 1 Lancaster Villas, Albert-road, South Norwood, S.E.
8 Dec. 1886.	MAYLARD, MARTIN W., 86 Lower Addiscombe-road.
Original.	McKEAN, KENNETH, F.L.S., Warham-road.
10 Nov. 1886.	McLACHLAN, ROBERT, F.R.S., F.L.S., 23 Clarendon-road, Lewisham.
19 Mar. 1879.	MENNELL, H. T., F.L.S., Park Hill Rise.
16 Dec. 1874.	MILLER, WILLIAM F., Canning-road.
18 Jan. 1882.	MILLN, JAMES STOCKS, Cyprus, Chichester-road.
18 Jan. 1882.	MORDAUNT, G., Glenearn, Epsom-road.

Date of Election.	
9 Jan. 1884.	MORGAN, JAMES HENRY, F.S.S., St. Ethelberga, Birdhurst Rise.
21 May, 1873.	MORLAND, CHARLES C., Rastrick Lodge, Morland-road.
14 Nov. 1883.	MORLAND, CHARLES ERNEST, Rastrick Lodge, Morland-road.
15 Dec. 1880.	MORRIS, A., Beddington, Surrey.
15 Jan. 1890.	MORRIS, J. E., Beddington, Surrey.
9 May, 1888.	MORRIS WILLIAM, C.E., The Kent Waterworks, Deptford, S.E.
19 May, 1880.	MORTON, SHADFORTH, M.D., Wellesley Villas, Wellesley-road.
Original.	MUGGERIDGE, T. BENJAMIN, The Vale, Sydenham, S.E.
Original.	NATION, W. J., 40 Thornton-rd., Thornton Heath, S.E.
13 Mar. 1889.	NEALL, GEORGE, 88 Lower Addiscombe-road.
11 Jan. 1888.	NEWMAN, E. OAKLEY, 16 Alexandra-road.
4 May, 1870.	NEWTON, CHARLES, Crossland Villa, Broad-green.
11 Jan. 1888.	OAKLEY, CHARLES F., Abbotsford, Sudbury-rd., Thornton Heath, S.E.
18 Feb. 1874.	OLDFIELD, JOHN, 16 Tamworth-road.
14 Nov. 1883.	PAGET, PETER, Jun., Coombe-lane.
18 May, 1881.	PARSONS, H. FRANKLIN, M.D., F.G.S., 13 Whitworth-rd., South Norwood, S.E.
9 Oct. 1889.	PEARL, Dr. EDWARD, Fairoak, Sylvan-rd., Upper Norwood, S.E.
19 Oct. 1870.	PEEK, Sir HENRY W., Bart., Wimbledon.
9 Dec. 1885.	PERKINS-CASE, P. W., M.D., Oakfield-road.
14 Sept. 1887.	PERRY, ARCHIBALD H., 6 Friend's-road East.
12 Nov. 1884.	PERRY, EDWARD SEAGER, 4 Morland-road.
17 Jan. 1877.	PELTON, JOHN, Warrington Lodge, Waddon.
21 Feb. 1872.	PETHERICK, H. W., Maple Lodge, Havelock-road.
19 Jan. 1881.	PHILIPS, JAMES, Woodlands, Wellesley-grove.
8 May, 1889.	PHILLIPS, S. P. L., Oxford House, Cherry Orchard-rd.
4 May, 1870.	PHILPOT, CHARLES W., M.D., Friends'House, Park-lane.
13 Feb. 1889.	PINNELL, ALFRED ERNEST, Winchester Villa, Carshalton.
13 Mar. 1889.	PITTMAN, J. J., 59 Dingwall-road.
11 Nov. 1885.	POOL, W., 53 Thornton-heath, S.E.
Original.	PRICE, GEORGE, N., 72 High-street.
14 Sept. 1887.	PRINCE, JAMES WEBSTER, Brickwood House.
9 Nov. 1887.	PURSER, J., 3 Madeira Villas, Upper Addiscombe-rd.
17 Jan. 1877.	PUXON, E. W., Wintons, Park Hill Road.
21 Jan. 1880.	PYE-SMITH, ARNOLD, Fairfield-road.
14 Jan. 1885.	READ, JOHN PHILIP, Eversfield, South Park Hill Road.
14 Jan. 1885.	REED, LESTER, F.C.S., F.I.C., Hyrst Hof, South Park Hill Road.
12 Mar. 1890.	REID, JAMES CHRISTIE, 43 Addiscombe-road.
12 Mar. 1890.	REID, JOHN JOHNSTONE, 4 Sydenham-road.
15 Sept. 1880.	RICH, ALFRED WILLIAM, Oak Villas, Fell-road.
17 Jan. 1877.	RICHARDSON, T. A., 24 London-road.

Date of Election.	
4 May, 1870.	RIDGE, BYRON, 112 North End.
19 Dec. 1877.	ROBINSON, G. E., Lee Villas, Canning-road.
18 Sept. 1872.	ROBINSON, W. MOSSE, Kenley, Surrey.
15 Feb. 1882.	ROBINSON, WM. JAS. PALMER, Lee Villas, Canning-rd.
18 Mar. 1874.	ROBY, R. F., Shirley House, Selhurst, S.E.
11 Jan. 1888.	ROODS, ALFORD, 35 Derby-road.
21 Oct. 1874.	ROSSER, WALTER, M.D., Wellesley-road.
14 Aprl. 1886.	ROSTRON, SIMPSON, Riverside, Beddington.
12 Mar. 1890.	RUSSELL, ALFRED CRAKE, 12A Clarendon-road.
12 Mar. 1890.	RYLEY, Rev. GEORGE B., 177 Lower Addiscombe-road.
18 Aprl. 1877.	RYMER, S. L., Wellesley-road.
12 Sept. 1888.	SANDELL, JOHN T., Abbotsford, Sudbury-rd., Thornton-heath, S.E.
19 Sept. 1877.	SARJEANT, W. LOW, 7 Belgrave-road, S. Norwood, S.E.
14 Jan. 1885.	SAUNDERS, THOMAS DODGSON, Twyfordbury, Park Hill Rise.
11 Aprl. 1888.	SCHMITZ, J. H., J.P., Lansdowne-road.
10 Nov. 1886.	SHEARER, DONALD, Park Hill House.
13 May, 1885.	SHORE, E. L., Millbrook House, Elmwood-road.
14 Aprl. 1886.	SKINNER, EDGAR, 10 Duke-street, St. James's, S.W.
9 Oct. 1889.	SLADE, SAMUEL HODDER, Richmond House, South Norwood Hill, S.E.
8 Feb. 1888.	SMITH, HAROLD, F.R. Met. Soc., Ingleside, Kenley.
14 Aprl. 1886.	SMITH, LANGLEY WM., Spring Lodge, Dean-road.
13 Feb. 1884.	SMITH, Dr. S. PARSONS, Addiscombe.
9 Jan. 1889.	SPARROW, C. H. BURNABY, 1 Chepstow-road.
15 Mar. 1882.	STANLEY JOSEPH, 17 Belgrave-road, S. Norwood, S.E.
Original.	STANLEY, W. F., F.G.S., Cumberlow, S. Norwood, S.E.
9 Jan. 1889.	STEVENS, SAMUEL, F.L.S., Loanda, Beulah Hill, Upper Norwood, S.E.
21 Dec. 1881.	STOW, ISAAC, 52 Canning-road.
20 Feb. 1878.	STRAKER, E., Hazelshaw, Kenley, Surrey.
11 Jan. 1888.	STREETER, J. S., High-street.
Original.	STRONG, HENRY, J., M.D., George-street.
12 Dec. 1888.	STUNT, G. N., Kenley, Surrey.
Original.	STURGE, EDWARD B., The Waldrons.
12 Dec. 1888.	SUTCLIFF, ROBERT, 6 Bramley Hill.
16 Sept. 1874.	SWAINE, J. C., Park Hill Road.
13 Sept. 1882.	SYMS, JOHN E., Stanton Villa, Stanton-road.
9 Mar. 1887.	TAYLOR, MARTIN, Southbridge-road.
11 Nov. 1885.	TERRY, W., Cambourne-road, Sutton.
11 Nov. 1885.	THOMPSON, A., 43 Carmichael-road, S. Norwood, S.E.
16 Jan. 1878.	THOMPSON, H. G., M.D., 86 Lower Addiscombe-road.
17 Nov. 1880.	THOMPSON, FRANCIS, Haling Park Road.
17 Nov. 1880.	TOPLEY, WILLIAM, F.R.S., F.G.S., Hurstbourne, Elgin-road.
9 Jan. 1884.	TREW, THOMAS N., M.D., Park Hill Rise.
12 Mar. 1890.	TUILL, CHARLES J. M., Marion Villa, Addiscombe-road.
10 Nov. 1886.	TURNER, A. W., Cambridge House, Canning-road.
18 Sept. 1872.	TURNER, HENRY, 33 Lansdowne-road.

Date of Election.	
19 Dec. 1877.	WALKER, THOMAS, C.E., Warrington-rd., Duppas-hill.
20 Dec. 1876.	WALTON, A., The Homestead, Bedford Park.
18 Dec. 1878.	WARD, JESSE W., The Chestnuts, Brighton-road.
19 Sept. 1877.	WARNER, A., 2 Grosvenor Villas, Holmesdale-road, Selhurst, S.E.
20 Aprl. 1881.	WATERALL, NATHANIEL, Waddon Lodge.
11 Jan. 1888.	WATERS, ALFRED, Stapleton House, Waddon Old-road.
9 Feb. 1887.	WAYDELIN, CARL, Jun., Bensham Villas, Broad-green.
15 Jan. 1890.	WAYTE, JOHN, M.D., B.A., 108 North End.
9 Jan. 1884.	WEBB, W., Jun., Lanoy Cottage, Duppas-road.
15 Jan. 1890.	WEBSTER, EDWIN, 234 South Norwood Hill, S. Norwood, S.E.
17 Oct. 1877.	WENHAM, W. P., Horndean, Waddon Old-road.
Original.	WEST, FREDERICK, The Waldrons.
17 Mar. 1875.	WHEALLER, G. ANSON, Allandale, Coombe-road.
9 Nov. 1887.	WILD, A. SCOTT, Canning-road.
12 Dec. 1883.	WILLIAMS, BERTRAM ALEX., L.D.S., 11 Wellesley-road.
12 Aprl. 1882.	WILLOUGHBY, C. W., Ivy Cottage, Parson's Mead.
13 Nov. 1889.	WISE, HOWARD R., Beechfield, Bramley-hill.
13 May, 1885.	WITT, S. J., 44 Dingwall-road.
17 May, 1871.	WOODWARD, JOHN, 1 Lee Villas, Canning-road.
12 Oct. 1887.	WRATTEN, F. C. L., 42 Canterbury-road.
12 Oct. 1887.	WRATTEN, SIDNEY HERBERT, 42 Canterbury-road.
9 Sept. 1885.	YOUNG, JOHN WOOD, Heathcot, Tavistock-road.

Honorary Members.

9 Sept. 1885.	BERNEY, FREDERICK LEE, Ravensbourne, Tambo, Queensland, Australia.
10 Mar. 1886.	CAMERON, Commander V. LOVETT, R.N., C.B., Kwinhata, Epsom-road.
21 Aprl. 1875.	COLE, R. BEVERLEY, M.D., San Francisco, California, U.S.A.
16 Aprl. 1879.	EVANS, JOHN, D.C.L., F.R.S., Hemel-Hempstead, Herts.
16 Aprl. 1879.	FLOWER, W. H., LL.D., F.R.S., Natural History Museum, South Kensington, London, S.W,
16 Aprl. 1879.	PRESTWICH, Prof. JOSEPH, Shoreham, Sevenoaks, Kent.
11 Jan. 1888.	SYMONS, G. J., F.R.S., 62 Camden-square, N.W.

Associates.

20 Aprl. 1881.	COLLYER, EDWARD B., Selsdon-road, Croydon.
11 Nov. 1885.	RODBOURN, J., The Garden, Coombes, Coombe-lane.

TRANSACTIONS

OF

THE CROYDON MICROSCOPICAL AND NATURAL HISTORY CLUB.

1889–90.

74.—Some Hints on the Preparation of delicate Organisms for the Microscope.

By Edward Lovett.

(Read February 13th, 1889).

Mr. Lovett said that such organisms as the ova of Mollusca, Crustacea, Fishes, &c., were often of such a nature as to be very difficult of permanent preservation, but he had succeeded in overcoming the difficulty satisfactorily by means of a fluid, the density of which he modified in accordance with the organism about to be mounted. This fluid was composed nominally as follows:—3 parts pure alcohol, 2 parts pure glycerine, and 1 part distilled water. This strength was suitable for young crustaceans, the ova of the fishes, and for the tougher ova sacs of the mollusca. For the ova of crustaceans and insects, and for that of the very small fishes, one or two parts more of distilled water might be added; whilst for such exceedingly delicate substances as the ova of the nudibranchiate Mollusca, zoophytes extended from their capsules; and for various delicate fresh water forms, a weaker formula than this was necessary; but as practice was the best instructor, he recommended his hearers to be guided by what they found to be the best proportions.

This fluid should be put into small glass tubes, with corks bearing numbers corresponding to those in a note book, so that full details of the contents might be recorded. These tubes should be taken down to the shore by the collector, and the organisms obtained should be placed therein *alive*, direct from the sea. The length of time required for the preservation of the object by the fluid varies according to the organism, from a week to a year; but some of Mr. Lovett's best preparations had been soaking, before being mounted, for five or seven years; and as a

proof of the value of the preservative fluid, he exhibited the mucous-like ova mass of an *Eolis*, which was in quite its natural condition, although eight years of age as a micro slide.

The cement used by Mr. Lovett for fixing cells for this fluid, for fixing the cover glasses to the cell wall, or for covering sunk cells, is composed of equal parts of red lead, white lead, and brown litharge, pounded to a powder and kept dry. When wanted for use, a little is mixed with japanner's gold size as thick as required, and it must be used with great care to ensure success, but in this case also the lecturer stated that practice was the best way to satisfactory results.

75.—Microbic Life in Sewer Air.

By Alfred Carpenter, M.D., J.P.

(Read April 10th, 1889.)

The peripatetic world is now and then convulsed by agitations against the smells which come from openings into sewers. "Shut them up," say the most energetic and demonstrative. Sometimes this is effected, sometimes it is not. In the heated discussions which spring up, in consequence of some stinking outlet, argument is useless. The loudest exclaimers often gain the day rather by the loudness of their declamation than by the correctness of their reasons.

I propose to consider the question in its bearing upon the public health in a scientific rather than in a partisan spirit.

The reasons for objecting to smells from sewers are sound enough. It has been proved conclusively that sewer smells do promote sickness. It is reasonable, therefore, that those who object to pay an unnecessary doctor's bill, and at the same time incur the risk of losing one of their beloved ones, should be loud in their antagonism to smells from ventilating gratings.

The first point to be determined is the actual nature of the smells, and, secondly, the causes which produce them. There are various kinds of smells, some pleasant, others objectionable, and some decidedly obnoxious, and one class is utterly offensive. This division is not satisfactory, because some smells which are grateful to some persons are most offensive to others. We cannot divide them in this way. Another classification might be made according to their manufacture. The odour of flowers and of individuals—human or animal—differ as to their causation from the odour of a gas works, and yet they are allied. These smells arise from chemical changes in the structures of the bodies engaged, which give off minute particles of matter,

usually of an ethereal or gaseous character; and being so they are endowed with the attributes which belong to gases, each atom having a repulsive action toward every one of its own kind. These odours are more or less rapidly oxidized when discharged into the air. They do not act injuriously upon human beings, except so far as they may take away the ozone or free oxygen in the atmosphere, and render the air less vivifying than it otherwise would be, and they cover up other and more dangerous smells.

The odours from individuals are also distinctive. Some individuals smell very disagreeably; but the mere smell is not capable of reproducing its kind any more than those from flowers and chemical decompositions, and is not, therefore, disease-producing. It cannot set up disease in other people. The odours from recently-discharged excreta are allied to this class. They are gaseous, have a tendency to diffuse themselves into space, are rapidly oxidized, and are not in any way Phœnix-like—that is, do not grow another generation of a similar kind. True, there are individuals with peculiar idiosyncrasies (as they are called) who cannot bear the smell of musk, or other penetrating odours. I have known one lady who could not stay in a room with a blossoming plumbago without feeling faint, though I could not detect any smell from the flower. But these are not cases in point. Stinks of this character may seriously affect a person, but there is no reproductive power in the smell. It is this point upon which I wish particularly to dwell, so as to bring before you the facts and the nature of so-called sewer gas. The smell of a recently used water-closet is very objectionable, but there is no probability of mischief to the next user on that account. It is no more injurious than is rose-water or the kennel of a fox. Fortunate for humanity that it is so. The odours from recent excreta are like to musk; they are ethereal, and tend to diffuse themselves, and so to become oxidized, and are rapidly destroyed. The excreta from a cholera or fever patient at its immediate discharge is perfectly harmless; but it is highly charged with ova, or germs of organic living matter, which are not so harmless. They are not volatile nor diffusible, like the ethereal smells of musk or of the fox. They require to be separated from the containing liquid, dried, lifted, and dispersed by currents of air. Where so carried they may or may not fall into congenial soils. Any one walking upon the chalk downs on a midsummer day may see the analogue of that which takes place in sewers. The air blowing over the South Downs lifts up the seeds of the various thistles which grow there, and carries them on to arable fields below, or out to sea. In the one case they reach a congenial soil and grow, to the vexation of the agriculturist; in the other they are destroyed. So it is with disease germs from sewers.

There is something more than smell or something less, as it has not been proved that disease microbes have any smell at all, and, of course, it is only those which cause disease that need be avoided, and the sewer must have a tidal state to enable these germs to find exit at the street openings. This brings me to another point in the case. There are benign microbes as well as malignant organisms. There are microbes which are friends to man, as well as those which are inimical. Take a cubic inch of mould from the Beddington Sewage Farm. It swarms with millions of living creatures, which are hard at work on a warm day preparing the organic matter in the humus by turning its nitrogen into nitrites ready for use by the vegetable world, if it happens that no radicle belonging to a carnivorous plant is at the moment ready to save the necessity for the change. It has been shown by direct experiment that the formation of the nitrites is due to this cause, and that the development of ammonia which takes place under some other circumstances, is also a reaction due to another organism of another kind, the result being acid in the one case, alkaline in another. In the one case putrescence is avoided, a nitrite or other acid being formed; in the other it is hastened, and ammonia results. Here we have another line. How does this alteration come about? The answer is that it comes about very much in the earth or in sewers as it does in the air; let oxygen abound, especially ozonized oxygen, and nitric acid tends to form. The organisms which cause this tendency grow as vigorously as does the yeast micrococcus in a solution of sugar. When the air is highly charged with electricity, the rain which descends in a thunder-storm contains an appreciable portion of nitric acid. But let the presence of oxygen be diminishing, and compounds of nitrogen form which are alkaline, and putrefaction is then promoted. A set of microbes come into being which are sometimes inimical to humanity; but here again we see the overruling hand of a Divine Providence, for one of the products of putrefactive agency, namely, sulphuretted hydrogen is completely destructive to those organisms that especially revel in the humours of animal life. This result is shown in the work of the doctor. It is our duty as students to do some dissecting in our student days, and we may be requested to do so at any time by the coroner. It sometimes happens that the operator wounds himself. I have experienced this while making post-mortem examinations upon those who have only been dead for forty-eight hours, more or less. This class of wound is always very serious, for disease germs may be transplanted; but a wound inflicted at the end of a dissection, when putrefaction is established, perhaps six or eight weeks after the death of the subject, has very little danger in it, for the disease-producing microbes, if they had been present,

have all been destroyed in the process of the putrefactive action which has taken place. This result happens in sewers as well as in dissecting-rooms.

There are two classes of microbes which have to do with destructive agencies—the moulds, which belong to the family of fungi, and the true microbe or schizomycites order. If air be sparsely admitted the moulds predominate, and there is a tendency to acid formations, carbonic acid, butyric, nitrous acid, &c.; but if it is all but excluded, the schizomycites are most numerous, and it is for this reason that ventilation must be good or not at all. We now reach a point of importance in the inquiry. Microbic life is connected with decomposition of organic matter containing nitrogen in its constitution. Decomposition is accelerated or checked by outside circumstances, such as the presence or absence of air; it is also influenced by temperature, by moisture, and the presence or absence of other agencies, as is proved by the action of antiseptics and germicides. We may even advance a step further, and say that without decomposition, there is no development of microbic life; this is an important factor in the consideration of sewer air.

Let us now inquire as to the nature of the decomposition which promotes the formation of these organisms. As experience is gained we become more and more convinced that there is no known means whereby any such organisms arise without the previous introduction of a parent germ of the same kind; that the spontaneous origin of such germs is not likely to happen; though no doubt in the case of some kinds of disease germs, such as that of typhus-fever, the dormant organism is an ever-present commodity, as much as that which gives rise to the blue mould in cheese. It is also established by experiment that a germ may be made more malignant by cultivation, or by cultivation may be deprived of its malignancy. It is upon this fact that vaccination is found to be prophylactic against small-pox, and Pasteur is able to prevent the spread of splenic-fever among cattle, and take out the sting of hydrophobia, by giving rise to a disease of a similar but of a milder type, though in the last-mentioned this may be only a choice of two evils.

Let us now ask whether any microbes are to be found in sewer air? Secondly, whether they are necessary parts of a sewer system? Thirdly, whether being there they are benign or malignant? And fourthly, whether it is possible for those which are benign to become malignant by cultivation in the sewer or outside, and *vice versâ*. My attention was first attracted to sewer air in the years 1853, 1854, and 1855. We had a ventilator fixed to the sewer at the Friends' School in 1854, which was then in Park Lane, Croydon. One of the teachers, who was of an inquisitive turn of mind, got on the roof and smelt at the

opening, with the sequence of a severe attack of sickness. It was the first case in which I was able to draw a distinct inference as to cause and effect with which I came into contact, though I was then satisfied that sewer gas did cause much illness in the town. It was not long before this event that I had ventilated the soil-pipes of my house, then in the Dingwall Road, the first ventilator of the kind which was put up in Croydon, and by that means, I think, saved my household from the invasion of typhoid-fever, which affected my neighbours in every house in that road right and left of me. From experiments carried out at that time in various houses in Croydon, I was satisfied as to the dangerous character of sewer air when coming from unflushed, unventilated sewers, and I determined to do my best to get the Croydon system of sewers both flushed and ventilated. It was not, however, until after the year 1865, with its distressing events, that the local authorities would agree to adopt the principle that every individual house should have its own protector from the invasion of obnoxious gases. About that time the experiments of the German scientist, Prof. Treber, of Dantzic, who followed up Erzenburgh's discoveries, had made out the connection between living organisms and disease, such as that which produced splenic-fever in cattle, and relapsing-fever in human beings. I began my own experiments on sewer air about this time, and tried to get some facts from personal observation which should be worthy of a place in the literature of this society. I had proved to my own satisfaction that *potato blight* was caused by a mould fungus (the *Peronospora infestans*), though I did not, for one moment, claim to be the discoverer, but only verified that which was suggested by others. I had learned that *dry rot* resulted from another fungus (the *Mereleus lachrymans*). I detailed my observations upon *Peronospora infestans* in the 'Times' newspaper, with the result of drawing upon me the anger of those who were working in the same field, perhaps in a more conclusive measure than I did, but of whose work in that particular field I was, like most other people at that time, quite unaware.

I followed out my observations upon sewer air by suspending microscopic slides in those positions in which sewer air was distinctly found to make its exit. While I was so engaged I made out that a number of Mr. Latham's charcoal baskets were inserted into openings into which air sometimes entered. These baskets had been provided to obviate the mischiefs from sewers by purifying the air issuing from them by means of charcoal; some were openings for the admission of air rather than as exits. This was especially the case with two or three openings at or near to the Zion Nursery, which had been complained of as nuisances, but which were conclusively proved to my own satisfaction to be

completely innocent of offence, for air went in instead of coming out, though it is quite probable that there was a reverse action occasionally. It was evident to me that the smell then complained of came from some other source than the sewer grating. The examination of the slides that I placed in the gratings showed a variety of organisms such as had been found in the wards of a large hospital, but I could not recognize any that I could accuse of being typhoid or other disease germs, which were the organisms I was more especially searching for. The arrested organisms were vibrios, micrococci and vegetable germs, innocent of malignant action on man, as far as our knowledge extended. I was not at that time aware of the plan of cultivation by means of gelatine solutions, such as are now so successfully used in similar investigations. Some of these I exhibited on a former occasion to the members of this society. I exhibited also some specimens and diagrams prepared by Dr. Heron, showing these developments, when I last addressed the society upon the subject of disease germs.

My last attempt at investigation in this direction was made upon a ventilating opening at the side of my garden upon Duppas Hill Terrace. The results of that investigation have been published in St. Thomas' Hospital Reports for the year 1883. They involved a medical question which I was anxious to submit to the medical profession, and did not detail them to this society. The substance of my observations, which were carried on in the winter of 1880–81, was that certain smells came from that ventilator which varied in nature as well as in intensity. Sometimes the smell was excessively offensive from the presence of sulphide of ammonium; at others there was an ordinary sewer air smell; and at others a sweet, hay-like odour, which could not be called distinctly offensive. I never smelt that particular smell at that sewer without getting a relaxed throat and a cough in the next day or two; and on two occasions, a distinct feverish attack lasting for forty-eight hours. There was one point of importance in the microscopical examination of the slides which I suspended in the ventilator—*viz.*, that whenever the sweet, hay-like smell existed, some very minute highly refractive organisms, smaller than the ordinary micrococci, were seen, which were always absent when the sweet hay-like smell was not perceived. I always suffered from relaxed throat after inhaling the sweet hay smell, and I came to the conclusion that the highly refractive particles were the germs which gave me the relaxed throat, and that they were non-existent when putrefaction was thoroughly established. If I had known anything of gelatine cultivation then, I should certainly have cultivated those germs, and tried to prove their connection with somewhat similar organisms which are found in diphtheria and croupous or infectious

pneumonia. (Some cases of these diseases did exist on Duppas Hill about that time). It was while making these investigations that I discovered a defect in my own left eye, which led me to give up microscopical research, and which has since disabled me from assisting at the Society's microscopic demonstrations.

Since that time I have been educating myself by the microscopic studies of others in the same direction. It has been clearly proved by experiment that actual putrefaction is generally destructive of the life of disease germs, so that the only result which need follow the inhalation of the offensive odours from sewers is the necessity of calling the attention of the local authorities to the fact that the sewer is a sewer of deposit, and before the stink escaped might have been a source of danger to those passing by that locality? We may depend upon it that it is not the sewers which stink that are the most dangerous, though before putrefaction was complete, it was possible that there might have been disease germs escaping from that particular opening, though I shall show presently that they need not excite serious alarm. Let us go back to

The Habitat of the Germ.

Many attempts have been made by various observers to catch the organism. So difficult is this, that Prof. Nageli, of Munich, endeavoured to show by a series of experiments which he carried on for some years, that they are not given off by moist surfaces; and Prof. Frankland said, in 1877, that nothing particulate was given off from running sewage; but as he has also shown us since then that the bursting of bubbles disseminated particles of lithia in solution, it is evident that whenever bubbles burst, any particulate matter in the substance of the bubble might be disseminated as well as the lithia. Some experiments have been made by Mr. J. S. Haldane, in the Westminster Palace sewer, which go to prove that micro-organisms were few whenever there was a regular current of air; that with little or no draught there was an increase of carbonic acid, and with that an increase of micro-organism, but they were moulds rather than bacteria. But another very curious thing was found to exist—*viz.*, that when the ventilation within the sewer was much improved, so so that CO_2 was materially diminished, there was a considerable increase in the number of bacterial organisms, as if a diminution of oxidation allowed of the increase of germs.

Mr. Haldane examined the air in the Bristol sewers, which are not ventilated. He found that in those sewers the moulds exceeded the bacteria, while in the air of the streets the bacteria exceeded the moulds.

Hesse has shown us that, although the spores of the moulds are much larger than the bacteria, they remain suspended in

the air much longer than do the bacteria. Mr. Haldane concluded that it is to the presence of air from without that we owe the more prolific existence of bacteria in sewers, and not *vice versâ*. His experiments led him to conclude that true sewer air contained fewer micro-organisms than the air of a street, or even the air of an ordinary living-room. Our experimenter did find, however, that when the sewage was splashed about, there was a large increase in the number of organisms observed, which is a great argument against the formation of large sewers. It is argued that there is much doubt as to the power of sewer air to disseminate typhoid germs independent of water supply. My own experience, arrived at by passing through three epidemics of that disease in Croydon, fully convinced me that when sewers, such as some of ours were in 1875, are loaded with typhoid excreta, the germs which are capable of reproducing the disease, do get conveyed from sewers into human beings by aërial means, either directly by air or through the water supply. In those epidemics the very large number of domestic servants, especially kitchenmaids and cooks, who became victims to the disease. was one of their marked characteristics, the reason being that those persons went downstairs into the basements in the early morning before the house was thoroughly ventilated, and inhaled the sewer air that had collected in the kitchen during the night. Then there was Dr. Buchanan's demonstration as to the reason why fever existed on one side of two or three streets which he specified, in which the water supply was the same, and the sewer the same on both sides. In one set of cases, the air was admitted into the houses from the sewer, in the other it was not. It is clear, however, that ordinary sewer air cannot produce mischief unless the organisms from particular forms of disease exist in the sewer. It becomes the bounden duty of the authority to take care that no such organisms continue to live and multiply there, and that when cases of any infectious disease exist in a given locality, they shall pay particular attention to the sewers in that locality, and prevent them from discharging disease germs into the streets from the open grids which are left for ventilating purposes. They will do this if they are only partially ventilated, and are sewers of deposit.

We are now in a position to answer the four questions which I have put forward. First: Do microbes exist in sewer air? No doubt they may. If, however, sewers are properly laid, and there is no sewage deposit, no impediment to discharge allowed to take place, and no stagnant air in any part of it, there will be no disease germs.

Disease germs require time for development, and if excreta be hurried away to their proper destination, where they may become *bonnes bouches* for the carnivorous plants which should be found

on sewage farms, there is an end of their *rôle* as disease germs. But if the sewers are sewers of deposit some germs may settle in the pipes; they may fructify there, and their living, growing spores be carried away by the currents of air and then discharged to the possible danger of the people. They are not, however, the necessary parts of a sewer system, but are the accidents of defect. I have not the least doubt myself that a stinking grating is not dangerous, from the circumstances I have mentioned. It is an undoubted fact that the panic in the House of Commons, by which the Metropolitan Board of Works was brought into being, was produced by stinks from the bed of the Thames. It was the healthiest year that London had experienced for a long time, as far as enthetic disease was concerned, at least, if statistics prove anything, and yet the Thames smelt so badly, that our senators could not carry on their work in the committee rooms of the House of Commons.

Stinking sewers should not be allowed to exist, but to my mind it is better to have the open grids in the streets than to convey the mischief, which is possible, into positions preventing our getting the knowledge that the sewers require to be scoured. Every line of sewer should be well scoured in the crown of its arch as well as at the bottom, and after the scouring, thoroughly flushed by a body of water that fills its calibre completely. The flushing which I see going on in our town from a two- or three inch tube, is all but useless for the purpose required, except where there is a stoppage, which produces a head of water and fills up the sewer. Sewers of comparatively small size, in exactly straight sections, so that they may have the lamp test applied, which can be flushed by the sudden discharge of a large body of water at frequent intervals, when the temperature of the sewer rises above a certain point, will remove the colonies of disease germs. They do grow on the sides and invert of the arch of sewers, as certainly as they may be made to grow in tubes containing pure solution of gelatine. If the ventilation is tardy, so as to allow of fructification, the colonies give off their spores, and these may possibly light upon a passer by, who happens to be infective, and upon whose mucous membrane the organism happens to fall. I say this is a possible contingency but it will rarely happen. These germs are of two kinds: the one is a living, growing organism; I may compare it to the barley which has been made to sprout in preparation for malting. If this organism be planted on a mucous surface ready for its reception it may take root, reproduce its kind, and set up its own form of disease; but, like the white corpuscles in human blood, exposure to pure air for a very short period indeed is fatal to it. The fact is made out in the operation called transfusion. If the blood in its

passage from one person to another be exposed to the air for more than a small fraction of a second, the corpuscle dies, and the patient, though at first reviving, afterward succumbs to the mischief produced by the dead fibrine. If growing germs are exposed to a current of fresh air, free from ammonia, and with its fair proportion of oxygen, in the sewers, the germs will be deprived of vitality before they escape into the open air. It is for this reason that the ventilation of sewers must be complete if such ventilation is to be safe. A partial ventilation does not provide for the death of the living, growing germ, and it is this living, growing germ which does the mischief; for the other form, the resting spore, will not rise from the watery bed. The growing germ is also destroyed by sulphuretted hydrogen and its binary compounds, the product of the decomposition of all albuminous matters. I say, then, that well-ventilated sewers are safe; they are doubly so if they are thoroughly and properly flushed. If they are not sewers of deposit they cannot produce sewer gas, and if they thoroughly stink, disease germs cannot live in them, so that in either case there is no danger; but there is a possible danger, when it is not discoverable by reason of smell, if those openings which give out offensive odours are occasionally free from the discharge of stinking matter, and some one who is not germ-proof stoops down at the opening. Children will be victims. In a pure atmosphere the life of the germ is momentary, and all serious danger is soon at an end. I have said in a pure atmosphere. If the air is impure, if it contains alkaline gas in the form of ammonia rather than the nitrous or sulphurous form of gases, there is the possibility of a much longer life for the germ than when the air is pure, or has an acid reaction. It is due to this fact that diseases spread in unventilated, dirty houses, and if it was not for the sulphurous acid which is found in the London smoke-fogs, it is most likely that the life-history of disease germs would be made more manifest than it is when we have an atmosphere entirely without ozone for days together.

We may take it as true that living disease germs from sewer ventilators are possible factors, but they are rarely provided. If the sewers are only partially ventilated, with tendency to the formation of carbonic acid in excess, there is a mould formation rather than bacterial life, and moulds are not yet proved to be zymotic disease germs to human beings. They are comparatively benign; like benign bacteria, they help to purify both air and water, and return the albuminoid or nitrogenous matters to their simple elements, ready for use by the vegetable world.

I cannot conceive benign organisms becoming malignant in the processes which take place in sewers unless the temperature

be raised much beyond that which is ordinarily found in proper sewers, with an abundant water supply. I mentioned, when speaking of sewer flushing, that this process must be frequent at certain times, when temperature is higher than usual. If at any time the temperature in this country should be continually high for a month or six weeks together, so that the temperature of the London water should be kept above 65 degrees for a month, London may prepare for a tremendous outbreak of typhoid in the succeeding autumn. It requires a continuously high temperature for probably a month to develop typhoid spores in the drinking water as at present manipulated at the filter works of the water companies. That season will come some day with the usual result, "panic," and consequent loss. For the same reasons, unless sewers have their temperature permanently raised for some time, there is no danger from benign germs being replaced by malignant; but I believe that it is possible for the continuous discharge of hot water so to raise the temperature of a drain-pipe, that it may be a hidden source of danger, and that such continuous discharges of hot water from manufactories may be dangerous in badly-constructed sewers, though an excessive heat, such as is experienced on a sunny day, destroys bacteria. But if sewers are well and truly laid; if the pipes are smooth inside and have been properly jointed; if they flush clean, and are properly flushed at intervals, depending upon the temperature of the sewage, then there is no real danger from the admission of hot water into sewers.

I think I have dealt with the four points to which I have drawn attention, and I will conclude what I have to say on this subject, by stating that the greatest danger from drains is not in the public sewer, but in the house connection, and in the private drains laid by speculative builders. These are only occasionally used, they become all but dry at frequent intervals; and if they are not as clean as a back kitchen sink ought to be, they will, in spite of all precaution, occasionally produce sewer air. They must be ventilated even more perfectly than the public sewers, and so cut off from all direct communication with the house, that it shall be absolutely impossible for any of the products of decomposition, if they arise, to find their way inside the dwelling, and carry living, growing germs with them. If these arrangements are carried into effect, those living in such houses may defy disease germs and live in perfect safety from their attacks; and, in the words of the Psalmist we may say:—1. "Thou shalt not be afraid of any terror by night, nor for the arrow that flieth by day; nor for the pestilence that walketh in darkness, nor for the sickness which destroyeth in the noonday. 2. A thousand shall fall beside thee, and ten thousand at thy right hand, but it shall not come nigh thee."

76. Short Abstract of a Paper on 'Ancient and Modern Science.'

By Robert Brodie, M.A.

(Read before the C. M. & N. H. S., on May 8th, 1889.)

It is not difficult to contrast the mental and material condition of the most advanced peoples in ancient and modern times. A comparison of Athens at the end of the 5th century B.C., with the most highly civilised nations of modern Europe, shows that while in painting, sculpture, architecture, history, poetry, philosophy, and the drama, the Athenians have not been surpassed, they were almost wholly unacquainted with the principles of physical science now known and applied to locomotion, manufactures, and all the needs of daily life. In some branches of philosophy, such as deductive logic, ethics, and metaphysics, their great thinkers have left works which will be valuable for all time; but physical science they either neglected altogether, or else they employed wrong methods in its cultivation, so that the conclusions at which they arrived were worthless. A sketch of the history of Greek philosophy, from Thales to Aristotle, shows how differently the ancients and the moderns approach the study of the laws of nature. The first man who deserves the title of "man of science" is Archimedes, 300 B.C. Between the time of Archimedes and the 7th century, A.D., some few discoveries were made, but from that time till the middle of the 16th century, science was at a standstill. In the "dark ages" few people had any knowledge, and those that had any wanted enlightenment to enable them to use it. By degrees the idea of liberty in the State, in religion, and in knowledge grew up, and by the time that Lord Bacon wrote his 'Novum Organum,' the world was prepared for a change in the methods of enquiry. Already Copernicus had laid the foundations of the new astronomy, and Tycho Brahe, Kepler, and Galileo, were all at work during some part of the period covered by Bacon's life, 1561–1626. In 1642 Newton was born, and from the latter half of the 17th century to the present day, the progress of science has been uninterrupted. In the days of Galileo there was some reason for the expectation that bigotry, by the aid of persecution, might stifle enquiry, and perpetuate the ignorance that served the purpose of the bigots. But all such hope has happily long ceased to exist, except in the minds of those who are intellectually on the level of the opponents of knowledge three hundred years ago. The torch kindled in the 16th century has been passed from hand to hand, and each generation has entrusted it to the next, blazing with a far brighter light than when it received it from its predecessor. When this great

Lampadelphoria, or torch-race of science began, we know—that the runners are in full swing now we know—but where it will end, and how long the course will take is hidden from our ken. What Clytemnestra, in the old Greek Tragedy, said of the beacon-fires that told her of the fall of Troy, we may say of the advance of science—

> "Such is the fashion of our race of lamps,
> Each in succession ministering to each,
> And both alike are conquerors, first and last."

77.—Some Coal-tar Products.

By James W. Helps.

(Read November 13th, 1889.)

The subject of my paper this evening is one about which so much can be said, that I feel myself placed in a position of some difficulty, as it is by no means easy, in the short space of time at my disposal, to give much more than a bare outline of a few of the products now obtainable from coal-tar. It will not be necessary for me to say much about the coal itself from which the tar is produced, as probably all here know the manner in which it was formed, and acknowledge its vegetable origin.

I must first of all briefly allude to the manner in which the tar is produced, and to do this must describe the earlier processes in the manufacture of coal-gas. A certain quantity of coal is placed in a retort made of fireclay, which is usually one of several, set in brickwork and heated by one fire common to all to a temperature of about 2000° F. (1100° C.). This retort is closed by a lid and the coal subjected to destructive distillation; the volatile constituents pass off through a pipe leading from the mouthpiece to a vessel called the hydraulic main. Now it is well known that substances require more heat to exist in a gaseous than in a liquid state, consequently, immediately on leaving the heated retort *condensation* commences, and one of the first results is the production of *tar*. The gases are, after leaving the main, conducted through a long series of pipes and condensers of various kinds, until their temperature is reduced to nearly that of the surrounding air; by this means almost the whole of the tar is thrown down; what little remains is removed when the gas passes through the washers and scrubbers, where also the ammonia and portions of certain other impurities are extracted.

We have now obtained *coal-tar*, the quantity of which, resulting from the distillation of one ton of Newcastle coal, is about

10½ or 11 gallons. It is a black, more or less viscid fluid, of specific gravity between 11 and 12. Before proceeding to describe the treatment which it undergoes at the tar distillers, I should like to give you a short chronological history of it and its principal derivatives, which will, I think, afford a very striking proof of the rapid strides which have been made in chemical research during the past fifty or sixty years.

No doubt, from the first, coal-tar has been used in small quantities as a cheap sort of paint, and towards the end of the last century Lebon, in France, pointed out the use of certain products obtained in the distillation of coal for the *preservation of timber*. In Germany also, after being boiled down and deprived of its volatile constituents, tar was used for making roofing felt. A further step was made towards making it a marketable commodity when the *naphthas* or *light oils* produced in the boiling of tar were used in dissolving the india-rubber which was being brought into use by *Mackintosh* in the manufacture of waterproof garments.

In 1820, Garden found in the tar oils a substance known as Naphthalene, which though thus one of the earliest products to be discovered, was one of the latest to be utilised.

In 1825, Prof. Faraday discovered Benzol, in oils produced by compressing oil-gas ; and in 1832, Dumas and Laurent discovered Anthracene, or "Paro Naphthaline" as it was called ; and the same year saw the production by Reichenbach of Creosote from wood-tar. Two years later Runge brought to light Carbolic acid, or Phenol ; and about the same time he proved the existence of Aniline (or Kyanol as he called it) in coal-tar.—I should say that Aniline (called Crystalline by the discoverer) was obtained in 1826, by Unverdorben, while distilling indigo.—The same chemist (Runge) was the producer of the first colour reaction, and in rather a strange way. He was engaged distilling some tar, and wishing to see whether the oils he had obtained contained ammonia, he dipped a strip of wood into some hydrochloric acid and held it above the still; the white fumes indicative of the presence of ammonia showed themselves, but he was surprised to see also, that the part of the wood which had been dipped in the HCl was dyed a deep crimson. He at once saw that he had found out some new substance, and he gave it the name of "*pyrrol*." He and others made many attempts to isolate it, but it was reserved for the present Prof. Greville Williams to achieve success. Pyrrol, however, still remains nothing but a chemical curiosity. Soon after this, *viz.*, in 1837, Pelletier and Walter, by the production of Toluene, made a discovery almost equal in value to that of Benzene. In 1838, a great impetus to the employment of coal-tar was given by the invention by Bethell of a method for

preserving railroad sleepers, &c., by soaking them with the creosote or heavy oils from coal-tar.

Still, however, the lighter oils were little used, except for burning and for dissolving india-rubber; their day came when *A. W. Hoffman*, in 1845, showed in them the presence of BENZENE, and when two years later his pupil, C. B. Mansfield, described the composition of these oils, and also a method of preparing pure benzene on a practical scale. His devotion to this research unfortunately cost him his life, for he was burnt to death through the bursting of an experimental still at which he was working. These discoveries were soon followed by the preparation of NITRO-BENZENE or *oil of mirbane*, frequently used as a substitute for the essential oil of bitter almonds.

Coal-tar still failed to attain any commercial value; but all this was changed when, in 1856, Mr. W. Perkin succeeded in producing the first aniline colour, especially as the starting-point for this, *viz.*, Benzol, was exclusively derived from coal-tar.

I have said that *Aniline*, under the name of *Crystalline*, was found out by Unverdorben, and Runge found in coal-tar a substance called *Kyanol;* the latter also found that a solution of this substance in water formed a dark purple on the addition of chloride of lime or bleaching powder, a rather strange result, as bleaching powder usually destroys rather than produces colour; but it was Hoffman, however, who proved that *Crystalline*, *Kyanol*, and *Aniline*, were one and the same thing. Now, Perkin, failing in some experiments he was making with Aniline, turned his thoughts in another direction, and the idea occurred to him that the *purple colour* obtained by the mixture of aniline and chloride of lime, could be fixed and used as a dye. He dissolved some aniline in sulphuric acid, added *bi-chromate of potash*, and obtained a dirty-looking precipitate; this he treated with alcohol, and produced a solution which imparted to his quill-pen, when boiled in it, a most brilliant PURPLE. Mr. Perkin made this colour on a large scale, and thus founded the industry known as the *Aniline Colour Trade.* Naturally, his success set other chemists to work, and it is hardly surprising that the number of derivatives from the tar-oils, &c., increased with great rapidity, and has gone on doing so ever since. Let me draw your attention to the chart, or "tar-tree," as it is called, showing over 600 different products, nearly all brought to light during the past 50 years.

Having now given you a brief history of the chief derivatives from coal-tar, I must give you some idea of the manner in which they are obtained. The first step is to *distil the tar;* this is done in wrought-iron stills of various forms, one of which is shown set in brickwork on drawing No. 1. A. is the still,

capable of holding about 1200 gallons, which quantity is run into it at the top. The fire is lighted at B, and as the tar warms distillation commences. This is at first attended with some danger, as the water in the tar causes it to rise and froth; the firing must therefore be conducted with great care, to avoid sudden boiling over. Vapours soon issue from the pipe C, at the top of the still; these are at first composed of water and the more volatile oils, called First Runnings, and after leaving the still they are led through a worm condenser, which is kept immersed in a vessel containing water, constantly on the flow. As these vapours condense, they pass on to a receiver; this vessel is provided with as many outlets as there are fractions to collect, each leading to a different stove-tank. As soon as these vapours nearly cease, the receiver is changed, and the temperature in the still (which so far has been kept below a certain point) increased. The distillation now becomes more rapid, and vapours are given off, which are condensed and collected under the name of Light Oils; these processes are repeated, and in turn the vapours of Carbolic Oil, Creosote Oil, and Anthracene Oil are distilled over, condensed, and collected. The principal guide which the attendant has to assist him, in making the different changes, is the thermometer in the still; but he has also to note the smell, specific gravity, and quantity of the distillates. It is usual to change at the following points:—

First runnings	up to	105° or 110° C.
Light oils	,,	210°
Carbolic oils	,,	240°
Creosote oils	,,	270°
Anthracene oils above that.		

After the anthracene oil ceases to flow, the residue is known as Pitch. This is allowed to cool, and carefully run out into proper receptacles.

The quantities of each of the above-mentioned substances, which can be obtained from a charge of 1200 gallons of tar, vary so much according to its quality and mode of distillation, that it is not easy to arrive at a satisfactory average.

According to Watson Smith, 1000 gallons of Lancashire tar, chiefly from Cannel coal, gave the following results:—

Ammoniacal liquor	25	2·2	
First runnings	38	2·2	
Light oils	131	10·6	Per cent.
Creosote oils	87	7·6	by weight.
Anthracene oils	191	16.9	
Pitch	$3\frac{1}{4}$	60·5	

On further treatment these products yielded—

90 per cent. benzol	6 gals.
Solvent naphtha	74·
Carbolic acid	6½
30 per cent. anthracene	0·50 cwt.
Equal to pure anthracene	·15 ,,

Having obtained the first-named products, further treatment is necessary before they are of much practical use; the light oils are therefore rectified for the production of naphthas of varying qualities. To obtain from these the benzol, toluene, &c., a very careful system of rectification is necessary.

We have now obtained the *Benzol* which is the compound used for the preparation of aniline; it is a colourless liquid with a peculiar smell, its formula is C_6H_6 sp. gr. at 0· C = 0·8991, boiling at 80° C. It is, of course, only possible for me to touch upon one or two of the various bodies which can be obtained from it; I will therefore proceed to explain the treatment adopted for the production of aniline.

To begin with, the benzol is treated with nitric acid, or a mixture of that acid with sulphuric acid; by this means one atom of the hydrogen in benzene is replaced by one of nitric peroxide, for the formation of *Nitro-benzene*, the properties of which I have already mentioned; this liquid is then washed with lime and water for conversion into aniline; it is generally subjected to a treatment discovered by M. Bichamp, which consists in reducing it by means of ferrous acetate.

It was, as I have said, from this *aniline* that Perkin made his purple dye; his success, of course, set others to work, and before long M. Veguin, by boiling aniline with *tetrachloride of tin*, produced a splendid crimson, known as *Magenta;* many other ways of making it were discovered, but that of Mr. Medlock was the great commercial success; it consisted in treating the aniline with arsenic acid, and resulted in a large fortune being made.

Let me quote Mr. Leicester Greville as to the tinctorial powers of this dye:—

"100 lbs. of coal = 5 lbs. of tar = 2 ozs. of benzene = 1040 grains or 2¼ ozs. of aniline = 207 grains of magenta. This quantity is sufficient to dye 8 lbs. of wool, or to print 207 yds. of calico: in other words, 1 grain of magenta will print 1 yd. of calico 1 per cent. in weight."

From magenta many beautiful dyes are obtained, such as Nicholson's blue, which I have here; it is an alkaline blue, and a fabric dyed in it is almost colourless, until dipped in a weak acid solution; it will not rub off.

Magenta treated with iodide of methyl gives a lovely green,

and, by a process commencing with the treatment of it with chloride of methyl, dimethyl-aniline violet is obtained; this is a very much-used dye.

I cannot say much about the further treatment and uses of carbolic oils and creosote oils; the value of the former as a disinfectant is well known to you; when it is treated with nitric acid Trinitro-phenol or Picric Acid is produced, which gives a delicate fast yellow dye. Its salts, such as the picrate of potassium, are very explosive.

From both creosote oil and carbolic oil Naphthalene is obtained; this is used in the production of the albo-carbon light. Until late years it has had but little value; now, however, many beautiful colours are made from it. I may mention Magdala red and Manchester yellow.

By the oxidising action of nitric acid it is converted into Phthalic Acid; this is connected with the benzol series, as when heated with excess of lime it is converted into benzene; it is the starting-point for the long series of colours known as the Azo-compounds.

I now come to a substance which I cannot dismiss quite so lightly. If you refer to Table A, you will see that in the distillation of tar a substance called Anthracene Oil is produced, coming off above the temperature of 270°. By cooling and pressing, the solid hydrocarbons are separated from the liquid ones, which latter are either re-distilled or used as lubricants. The solid portion is further washed and pressed into anthracene cake. Its formula is $C^{14}H^{10}$, and it boils at 360°. It was of little use until the discovery by Græbe and Lieberman that from it could be produced *Alizarine*, the colouring principle of the madder plant (*Rubia tinctorum*). Now this plant has been used for the purpose of obtaining a red dye from time immemorial. The process is said to have originated amongst the inhabitants of Malabar and Coromandel, from whence it was introduced into the Levant, where no doubt it received its name of "Turkey Red." It gradually spread to Russia, France, and finally to Great Britain.

The plant itself yields only about 1 to 1¼ per cent. of colouring matter, and on this account many attempts were made to isolate this latter, and in 1826 Colin and Robiquet obtained from the plant a substance which they called *alizarine*. From time to time further investigations were made, and in 1868 Græbe and Lieberman found, on submitting alizarine to a certain process, that they obtained a substance identical with anthracene; they then reversed the process. A substance known as "anthraginnone" ($C^{14}H^{8}O^{2}$) had previously been obtained from anthracene by oxidation; this was treated by Græbe and Lieberman first with bromine and then with caustic potash. As

a result they obtained *alizarine*, or the colouring principle of the madder plant. This treatment by bromine, however, proved too expensive, and soon two patents, one by Perkin in England, and the other by Caro Græbe and Lieberman, were brought out, heated sulphuric acid being thereby substituted for bromine. These patents were subsequently combined. The production of artificial alizarine has now almost superseded the natural product, and the growth of the plant has almost ceased.

Of late years many other important discoveries have been made, including one described by Sir Henry Roscoe as "the most remarkable of all the marvellous products of the Coal-tar Industry." I allude to *Saccharine*, the discovery of which is due to Dr. Constantin Fahlberg. He was engaged in studying the oxidation products of the toluene sulphamides, and found that by oxidising pure ortho-toluene sulphamide he obtained a remarkably sweet compound. By much further study and research, extending over several years, he succeeded in producing *saccharine* on a practical scale; its starting-point is toluene, which in the first place is heated with sulphonic acid, forming toluene sulphonic acid; the succeeding treatments, six in number, are somewhat complicated, and it is hardly advisable for me to enumerate them, the final one, however, is the oxidation of the ortho-toluene sulphonic-amide by potassic permanganate in the presence of an alkali, and the precipitation of the resulting product with a dilute mineral acid, when *Benzoyl-sulphonic-imide*, or *saccharine*, separates out.

I have here a sample of the pure product, which is some 300 times sweeter than cane sugar, and also a sample in its commercial and soluble form. On account of its great sweetening power it is claimed that it is as cheap as sugar at 3d. per pound.

It is of great value in medical cases, being powerfully antiseptic and non-fermenting, and can be given to persons who are forbidden the use of sugar.

I would also mention a substance, a derivative of Coal-tar, which is greatly used in pharmacy, viz., *Antipyrin*, a febrifuge of certain action; it is also claimed to be of great value in the treatment of sea-sickness, and, in fact, in various other ailments. I fear I have already taken up more of your time than is usual on these occasions, and must therefore content myself with having given you but a slight insight into the productive properties of *Coal-tar*.

78

~~77~~. THE REPORT OF THE METEOROLOGICAL SUB-COMMITTEE FOR 1889.

(Read February 15th, 1890.)

The arrangements for observing the daily rainfall round Croydon have been successfully carried out on the same plan as last year. The year commenced with a staff numbering 38 observers, superintending 45 stations, as against 31 observers, superintending 34 stations in 1888. Of these 45 stations two have been discontinued. Mr. Baldwin Latham left Park Hill, and Mr. Heward has discontinued taking observations at New Malden, though still continuing those at the Sewerage Works. Two stations also have been moved in the course of the year, Mr. Bayard moved on June 1st to another house in Wallington, within one hundred yards of his old residence, and the same height above sea level; and Mr. Marriott moved, on September 11th, to another house, some distance away from his old one at West Norwood, and in consequence only monthly totals have been given from that date to the end of the year. Captain Cleeve, R.E., who kindly continued Captain Sherrard's observations at Woolwich, found himself unable to continue the daily observations, but has taken monthly ones.

Appendix I. to this Report contains a list of the observers, with particulars relating to the stations and gauges. The two stations with the asterisk prefixed were admitted after the commencement of the year, and the three with the double asterisk are stations which sent in reports in the previous year.

Appendix II. contains the tables of daily rainfall issued monthly, and subsequently stereotyped.

Appendix III. gives the monthly rainfall of the five other stations.

And, finally, Appendix IV. gives a record of all falls of rain of 1 inch and upwards in the 24 hours, extracted from Appendices II. and III.

As explained in last year's report, the stations have been this year arranged as far as possible in districts. This arrangement, as a whole, has given satisfaction to the observers and others interested, though certain anomalies have appeared which will be corrected in future years. Esher will in future be placed just before Surbiton, instead of after Ashtead. A new station at Farningham Hill on the Darenth will be placed next to Orpington, and will be followed by Wilmington, formerly at the end of the list. The accession of Denbies, Ranmore Common, though on the further side of the Mole, is most welcome, as it fills up a very palpable gap. The Sub-Committee would be very

glad to hear of stations with daily records at Botley Hill and Betsom Hill, Knockholt and Erith.

With reference to the rainfall during the year, if it is allowable to take as a fair average the records of the stations in the district which have the longest reliable average, namely, Greenwich, with 45 years, and Kew and Surbiton, with 30 years, it would seem that it has been deficient. All these stations, it should be noted, are in the Thames valley; and, perhaps, it would be hardly right to compare them with stations more in the interior of the district, but for the fact that the result of a short rainfall is borne out by the shorter averages, 15 years and 10 years, of several other stations. Taking all these averages into consideration, it is probable that the average deficiency of the rainfall has been about 1 inch. Of the falls of rain in the district, of 1 inch and upwards in 24 hours, the only remarkable one is that of September 2nd, in the Darenth Valley. This day will long be remembered in that district. A thunderstorm raged in Essex on that day; at North Ockendon, 4·55 inches of rain fell, and at Upminster Hall, 4·32 inches. At Dartford, 4·00 inches fell, at Wilmington, 3·90 inches, and at Farningham Hill, 2·46 inches. It would have been interesting to have traced the course of this storm, had there been a sufficient number of stations on the extreme eastern portion of the district.

In conclusion, the Sub-Committee ventures to express a hope that members of the Club will seek to secure the help of persons willing to provide and keep rain gauges in the south-eastern, eastern, and north-east portions of the district.

APPENDIX I.

Stations.	Observers.	Size of Gauge.	Height of Gauge above Ground.		Height of Station above Sea-level.
		IN.	FT.	IN.	FT.
SURREY.					
*Dorking (Denbies)	J. Beesley	5	0	6	610
Reigate Hill (Lovelands)	R. Binns	5	1	3	600
Caterham (Caterham Asylum)	G. S. Elliott, M.D.	5	1	0	610
KENT.					
*Knockholt (The Beeches)	W. Morris, C.E.	5	1	0	785
SURREY.					
Marden Park (Birchwood House)	C. & F. Rutley	5	1	0	471
Kenley (Ingleside)	Harold Smith	8	1	0	375
Purley (Reedham Asylum)	J. A. Carter	5	1	0	375
Purley (Tudor Cottage)	J. Bonwick	5	1	0	216
Ashtead (D'Abernon Chase)	Sir W. Vincent, Bart.	5	1	0	300
**Esher (West End)	W. H. Dines	5	1	0	51
Esher (Sewerage Works)	Baldwin Latham, C.E.	5	1	0	40
Sutton (Mulgrave Road)	W. Goode	5	5	6	230
**Sutton (Grange Road)	W. Thurtell	5	1	6	230
Carshalton (The Wrythe)	J. W. Manley	5	4	10	107
Wallington (Manor Road)	F. C. Bayard	5	4	1	157
Beddington (Riverside)	S. Rostron	5	1	0	120
Waddon (Waddon House)	P. Crowley	5	1	0	156
Croydon (Brimstone Barn)	Croydon Corporation	5	1	0	130
Croydon (Dingwall Road)	Croydon Corporation	5	1	0	195
Croydon (Park Hill Rise)	Baldwin Latham, C.E.	8	1	0	253
Addiscombe (Outram Road)	E. Mawley	8	0	9	202
Addington (Park Farm)	W. Whalley	5	1	0	268
Addington (Pumping Station)	Croydon Corporation	8	1	0	331
KENT.					
West Wickham (Layham's Farm)	W. Ashcroft	5	1	0	500
Hayes Common (The Warren)	Miss Akers	5	1	0	296
Keston (Bradfield)	A. Hill	5	1	0	350
Keston (Heathfield)	Miss M. Holland	5	0	6	420
Keston (Tower Fields)	G. Buchanan, C.E.	8	0	9	351
Orpington (Kent Waterworks Co.)	W. Morris, C.E.	5	1	0	220
Chislehurst (The Chestnuts)	J. B. Snell	5	1	0	325
Bickley (Highfield)	J. Batten	5	1	2	295
Beckenham (Foxgrove)	P. Bicknell	5	0	6	142
SURREY.					
Wimbledon (Sewerage Works)	W. S. Crimp, C.E.	5	1	0	58
Wimbledon (Mount Ararat)	T. Devas	12	3	0	157
Raynes Park (Pumping Station)	W. S. Crimp, C.E.	5	1	0	47
New Malden (Gosforth Lodge)	T. L. Heward, C.E.	5	4	0	48
New Malden (Sewerage Works)	T. L. Heward, C.E.	5	1	0	45
Surbiton (Seething Wells)	R. Hack, C.E.	10	0	6	25
Kingston (Sewerage Works)	J. Stevenson	5	1	0	25
Richmond (Ormond Lodge)	J. T. Billett	5	0	9	51
Kew (Kew Observatory)	Kew Committee	11	1	9	19
Brixton (Acre Lane)	F. Gaster	8	1	0	77
West Norwood (Chapel Road)	W. Marriott	8	1	0	185
KENT.					
Sydenham (Longton Grove)	M. J. Porter	8	4	6	220
Forest Hill (Dartmouth Road)	Mrs. Behrens	5	1	0	220
Deptford (Kent Waterworks Co.)	W. Morris, C.E.	5	1	0	20
Greenwich (Royal Observatory)	Astronomer Royal	8	0	5	155
**Woolwich (Shooter's Hill)	Capt. S. D. Cleeve	5	1	0	352
Eltham (Victoria Road)	Capt. M. S. Richardson	5	1	0	205
Wilmington (Kent Waterworks Co.)	W. Morris, C.E.	5	1	0	25

APPENDIX II.

Daily Rainfall. **January, 1889.**

Day of Month	Reigate Hill	Caterham	Marden Park	Kenley	Purley (Reedham)	Purley (Tudor C.)	Ashtead	Esher	Sutton	Carshalton	Wallington	Bedding ton	Waddon	Croydon (Brim. Bn.)	Croydon (Ding. Rd.)	Croydon (Nant. H.)	Addis-combe	Addington (Park Fm.)	Addington (Hare's B.)	West Wickham	Hayes Common	Keston (Bradfield)	Keston (Heathfd.)	Keston (Kes. Tow.)	Orpington
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
2	..	..	..	..	..	..	..	..	..	·03	·03	..	..	..	..	·01	..	..	·01	..	..	·02	·02	..	..
3	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	·02	..	..	..	..	..	..	..	..	..	..
4	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
5	..	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·06	..	..	·02	..	..
7	·03	..	·01	..	..	..	..	..	·03	·01	·01	..	..	..	..	·01	..	..	·01	..	..	..	..	..	..
8	·05	..	·02	·06	·02	·04	..	·05	·07	·04	·04	·03	·02	·04	·01	..	·02	·02	·01	..	·02	·01	..	·03	..
9	·65	·57	·42	·46	·48	·43	·38	·26	·28	·30	·37	·31	·35	·32	·43	·38	·37	·38	·42	·35	·36	·28	·34	·30	·37
10	·36	·39	·15	·19	·25	·20	·27	·09	·18	·16	·20	·15	·15	·14	·12	·17	·17	·15	·18	·11	·12	·14	·14	·14	·12
11	..	..	..	..	..	·02	..	..	..	·03	..	..	·02	..	·03	·01	·01	..	..	..	..	..	·02	..	..
12	·34	·30	·28	·25	·26	·24	·20	·12	·15	·10	·15	·14	·14	·15	·13	·17	·17	·26	·18	·18	·26	·32	·35	·33	·30
13	·01	..	·03	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·11	..	..	..	·01	..	·12
14	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
15	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
16	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
17	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	..	·01	..	..
18	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..
19	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..
20	·18	·22	·21	·22	·20	·19	·19	·13	·18	·16	·18	·13	·16	·16	·17	·17	·19	·16	·15	·18	·17	·16	·17	·18	·16
21	·03	·04	·02	·04	·03	·03	·04	..	·04	·03	·03	·02	·03	..	·02	·02	·03	·03	·04	·03	·03	·02	·03	·02	·03
22	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·02	..	..
23	..	..	..	·01	..	..	..	..	..	·01	·01	..	..	..	..	·01	..	..	..	..	..	..	·01	·01	..
24	..	..	·01	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..
25	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
26	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..
27	·01	..	..	·01	·02	·02	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	·01	·01	..	..
28	..	..	·02	..	..	..	·02	·05	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..
29	·14	·05	·14	·13	·09	·10	·08	·05	·08	·08	·09	·07	·07	·08	·09	·09	·10	·10	·11	·13	·10	·07	·10	·11	·08
30	·05	·17	·06	·10	·08	·10	·05	·06	·07	·05	·06	·06	·05	·05	·06	·06	·07	·07	·08	·07	·08	·06	·08	·08	·06
31	·03	·05	·05	·06	·06	·05	·05	·04	·05	·04	·04	·04	·04	..	·03	·02	·03	·03	..	·03	·03	·03	·03	·03	..
Total	1·89	1·79	1·44	1·53	1·49	1·44	1·28	0·85	1·14	1·05	1·21	0·95	1·03	0·94	1·11	1·13	1·16	1·20	1·30	1·15	1·17	1·12	1·39	1·24	1·24
From Jan. 1	1·89	1·79	1·44	1·53	1·49	1·44	1·28	0·85	1·14	1·05	1·21	0·95	1·03	0·94	1·11	1·13	1·16	1·20	1·30	1·15	1·17	1·12	1·39	1·24	1·24

Day of Month	Chislehurst	Bickley	Beckenham	Wimbledon (Sew. Wks.)	Wimbledon (Mt. Ararat)	Raynes Park	N. Malden (Gos. L.)	N. Malden (Sew. Wks.)	Surbiton	Kingston	Richmond	Kew	Brixton	West Norwood	Sydenham	Forest Hill	Deptford	Greenwich	Eltham	Wilmington
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	..	..	..
2	..	..	·01	..	..	·03	..	..	..	..	..	..	..	·02	..	..	·01	..	..	..
3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
4	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
6	..	·03	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..
7	..	·02	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	..	..	..
8	·01	·02	·01	..	·06	·04	·04	·04	·03	..	·06	·01	·03	·02	..	·04	..	..	·04	..
9	·23	·30	·29	·21	·31	·20	·21	·21	·20	·30	·18	·28	·25	·23	·35	·06	·24	·29	·27	·27
10	·10	·11	·08	·15	..	·15	·13	·13	·14	·12	·15	·12	·12	·14	·04	·44	·06	·06	·04	·03
11	·02	..	·02	..	..	..	..	..	..	..	..	·02	..	..	..	·03	..	..	·03	·04
12	·11	·22	·14	·16	·18	·16	·13	·13	·11	·17	·18	·12	·15	·17	·19	·03	·15	·13	·15	·29
13	..	·02	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·03
14	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
15	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
16	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
17	·01	·01	..	..	..	..	..	..	..	·01	..	..	..	..	..	..	..	·01	·01	..
18	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	·01	..	..
19	..	·01	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	·02	..	..
20	·13	·17	·15	·10	·15	·16	·14	·14	·10	·13	·13	·09	·15	·14	·18	·08	·12	·12	·19	·22
21	·01	·03	·02	..	·03	·03	·03	·03	·01	·03	·03	·03	·04	·04	..	·06	·02	·01	·02	·02
22	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	·05	·03	..	..	..	..
23	·01	·01	..	..	..	·01	..	..	..	·01	..	·01	..	..	..	..	..	..	..	..
24	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
25	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
26	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
27	..	..	..	..	..	·02	..	..	..	..	·02	·01	·01	..	..	..	·01	·01	..	..
28	..	..	..	..	..	·03	·02	·02	·01	·01	..	·01	·01	..	..	·02	..	..	·01	..
29	·13	·12	·10	·07	·10	·07	·06	·06	·05	·09	·09	·07	·08	·08	·12	·04	·06	·07	·09	·09
30	·04	·07	·05	·02	·10	·06	·04	·04	·05	·04	·06	·05	·05	·05	·05	·05	·03	·04	·05	·04
31	·05	·04	·04	·05	..	·04	·04	·04	·04	·04	·05	·04	·07	·05	·04	..	·04	·06	·04	·03
Total	0·85	1·18	0·91	0·76	0·94	1·00	0·84	0·84	0·74	0·95	0·95	0·91	0·96	0·94	1·02	0·88	0·74	0·84	0·94	1·06
From Jan. 1	0·85	1·18	0·91	0·76	0·94	1·00	0·84	0·84	0·74	0·95	0·95	0·91	0·96	0·94	1·02	0·88	0·74	0·84	0·94	1·06

Note.—The observations are taken at 9 a.m., except at Brixton (8 a.m.), and Croydon (Dingwall Road) and Kew (10 a.m.)

NOTES.

(January, 1889.)

The month has been mild, with a great prevalence of fogs, but a deficiency of rainfall and sunshine. Snow fell on the 12th.

Daily Rainfall.

February, 1889.

Day of Month	ReigateHill	Caterham	Marden Park	Kenley	Purley (Reedham)	Purley (Tudor C.)	Ashtead	Esher	Sutton	Carshalton	Wallington	Bedding-ton
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	..	..	..	·01	..	..	..	..	..	..	..
2	·13	..	·04	·04	·05	·04	..	..	·04	·06	·04	·04
3	·15	·37	·07	·19	·22	·20	·32	·26	·24	·21	·20	·17
4	·03	·05	·05	·04	·05	·03	..	..	·03	·03	·03	·02
5	·04	·03	·01	·02	·02	·05	·04	·03	·01	·02	·02	·03
6	·47	·40	·37	·41	·40	·40	·38	·30	·37	·36	·38	·38
7	·01	..	·01	·02	·01	·05	..	..	..	·01	·01	·01
8	·05	..	·07	·11	·11	·10	·03	·03	·06	·08	·09	·08
9	..	..	..	..	..	..	..	..	..	..	..	..
10	·80	·65	·56	·52	·40	·28	·52	·41	·41	·48	·53	·50
11	..	..	·02	..	..	..	..	·01	..	..	·03	..
12	..	..	..	..	..	..	·06	·01	..	..	..	..
13	·78	·50	·27	·24	·16	·53	·48	·15	·18	·17	·20	·18
14	·35	·20	·29	·31	·31	·33	·29	·23	·29	·29	·32	·32
15	..	..	·01	·01	·01	·02	..	..	..	..	..	..
16	·08	·15	·13	·17	·13	·11	·09	·10	·13	·11	·11	·10
17	..	..	..	..	..	..	..	..	..	..	..	..
18	..	..	..	..	..	..	..	..	..	..	..	..
19	·09	..	·03	·03	·04	·03	·08	·05	·05	·04	·03	·02
20	·22	..	·06	·09	·09	·09	·18	·08	·07	·04	·06	·06
21	..	..	..	·01	..	·02	..	..	·01	·01	·01	..
22	..	..	..	..	·01	..	..	..	..	..	..	..
23	·01	..	·01	..	..	·03	..	..	..	..	..	..
24	·01	..	·02	·01	·02	·02	..	·01	..	·02	..	·01
25	·03	..	·04	·02	·02	·03	..	·06	·03	·02	·01	·02
26	..	..	..	·01	..	..	·03	..	·02	·01	·01	·01
27	·05	..	·08	·04	·07	·08	..	·02	..	·05	·05	·06
28	·08	·20	·11	·12	·12	·12	·04	·04	·06	·06	·08	·08
Total	3·38	2·55	2·25	2·41	2·25	2·56	2·54	1·79	2·00	2·07	2·21	2·09
From Jan. 1	5·27	4·34	3·69	3·94	3·74	4·00	3·82	2·64	3·14	3·12	3·42	3·04

Day of Month	Waddon	Croydon (Brim. Bn.)	Croydon (Ding. Rd.)	Croydon (Nant. H.)	Addis-combe	Addington (Park Fm.)	Addington (Hare's B.)	West Wickham	Hayes Common	Keston (Bradfield)	Keston (Heathfld.)	Keston (Kes. Tow.)	Orpington
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	..	·01	..	·01	..	·03	..	..	..	..	..	·04
2	·04	·05	·04	·03	·05	·05	·08	·02	·04	·03	·05	·05	..
3	·17	·17	·19	·21	·22	·21	·19	·22	·28	·28	·28	·31	·32
4	·02	·02	·01	·02	·03	·05	..	·05	·05	·05	·05	·04	·08
5	·03	..	·03	·02	·02	·03	·05	·02	·03	·02	·04	·02	·02
6	·39	·36	·42	·42	·42	·37	·44	·43	·39	·35	·09	·41	·40
7	·01	·01	..	·01	·01	·07	·01	..	·01	·04	·02	·01	..
8	·10	·07	·07	·07	·07	·08	·09	·08	·09	·07	·09	·10	·12
9	..	..	..	..	..	..	..	..	..	..	..	..	..
10	·43	·39	·52	·59	·43	·50	·42	·36	·42	·41	·54	·62	·45
11	·02	..	..	..	·01	..	..	..	·08	..	·01	·01	..
12	..	..	..	..	..	·05	..	..	..	..	·01	..	..
13	·16	·16	·19	·18	·18	·17	·17	·24	·16	·12	·18	·18	·17
14	·33	·31	·35	·35	·37	·39	·37	·43	·48	·44	·44	·50	·54
15	..	..	..	..	..	..	..	·01	..	..	..	..	..
16	·12	·10	·11	·11	·11	·11	·11	·14	·11	·09	·10	·11	·11
17	..	..	..	..	..	..	..	..	..	..	·02	..	..
18	..	..	..	..	..	..	..	..	..	..	·01	..	..
19	·01	·01	·03	·02	·02	·02	·02	·01	·01	..	·01	·01	..
20	·06	·05	·05	·05	·06	·09	·08	·12	·11	·12	·11	·10	·07
21	..	..	·01	·01	·02	·01	·01	·01	..	·01	·02	·01	..
22	·01	..	..	..	..	..	..	..	..	..	·01	·02	..
23	..	..	..	..	..	..	..	..	..	..	·01	..	..
24	·01	..	·01	·01	·01	·01	..	..	·04	·02	·02	·01	..
25	·02	·04	·03	·02	·02	·03	·03	·02	·02	·03	·03	·03	·03
26	·01	..	·01	..	·01	·01	..	..	·01	·01	·01	·01	..
27	·02	..	·03	·06	·06	..	·05	·08	·05	·08	·07	·06	·08
28	·04	..	·10	·08	·08	·15	·10	·15	·11	·15	·15	·14	·14
Total	2·00	1·74	2·21	2·26	2·21	2·40	2·25	2·39	2·49	2·32	2·37	2·75	2·57
From Jan. 1	3·03	2·68	3·32	3·39	3·37	3·60	3·55	3·54	3·66	3·44	3·76	3·99	3·81

Daily Rainfall. February, 1889.

Day of Month	Chislehurst	Bickley	Becken-ham	Wimbledon (Sew. Wks.)	Wimbledon (Mt. Ararat)	Raynes Park	N. Malden (Gos. L.)	N. Malden (Sew. Wks.)	Surbiton	Kingston	Richmond	Kew	Brixton	West Norwood	Sydenham	Forest Hill	Deptford	Greenwich	Eltham	Wilming-ton
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	..	..	·01	..	·01	..	..	..	..	..	..	..	..	..	·01	..	..	·01	..
2	·03	·02	·05	·04	..	·04	..	..	·06	·06	·05	·05	·05	·03	·01	·05	·03	·05	·04	·10
3	·28	·35	·31	·22	·26	·22	·24	·24	·20	·21	·17	·20	·20	·22	·27	·26	·31	·28	·28	·15
4	·01	..	·02	·03	..	·02	..	..	·01	..	·02	·01	·02	·02	..	·11	·01	·02	·04	·03
5	·02	·09	·04	·03	·04	·03	..	..	·01	·02	·03	·02	·02	·03	·06	·05	·02	·02	·03	·02
6	·36	·40	·45	·35	·37	·36	·31	·31	·30	·34	·28	·26	·36	·40	·46	·14	·34	·35	·39	·30
7	..	..	·01	·01	..	·01	..	..	..	..	..	..	·02	·01	..	·10	..	..	·01	·03
8	·14	·18	·13	·06	·06	·07	·05	·05	·03	·04	·08	·12	·10	·07	·07	·04	·15	·12	·15	·11
9	..	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..
10	·50	·50	·50	·53	·43	·55	·57	·57	·54	·59	·61	·49	·51	·53	·42	·46	·45	·51	·45	·30
11	·01	..	..	..	..	·01	..	..	..	·01	·01	·01	..	..	..	..	..	..	..	..
12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
13	·14	·16	·18	·20	·20	·19	·15	·15	·16	·18	·22	·18	·25	·22	·22	·21	·22	·17	·20	·12
14	·46	·45	·45	·38	·38	·35	·29	·29	·26	·34	·35	·37	·43	·41	·44	·42	·38	·37	·47	·40
15	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
16	·12	·13	·12	·11	·12	·13	·11	·11	·10	·11	·11	·11	·14	·13	·14	·14	·12	·11	·12	·08
17	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..
18	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
19	·02	·03	·01	·02	·06	·03	..	..	·05	·05	..	·03	·01	..	·01	..	..	·01	·02	·05
20	·04	·07	·10	·04	·10	·08	·10	·10	·14	·09	·10	·05	·11	·11	·10	·08	·03	·04	·03	·02
21	·01	·01	·01	·01	..	·01	..	..	..	..	·01	..	..	·02	..	·02	..	·01	..	..
22	..	..	..	·02	·01	·02	..	..	..	..	·04	·06	·01	..	..	..	..	..	..	..
23	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01
24	·01	..	·01	·02	..	·01	..	..	..	..	·01	·01	·01	·01	·02	..	·02	·01	·02	·01
25	·03	·05	·03	·01	..	·01	..	..	·02	..	·04	·04	·01	·02	·02	..	·02	·02	·02	·01
26	·01	..	..	..	..	·01	..	..	..	·02	..	..	·01	..	..	·06	·01	·01	..	..
27	·05	·11	·05	·06	..	·04	..	..	·02	·05	·06	·04	·04	·05	·12	·04	·04	·06	·02	·02
28	·04	·11	·06	·05	·10	·04	·06	·06	·03	·02	·04	·02	·04	·07	·12	·06	·05	·04	·12	·10
Total	2·29	2·66	2·53	2·21	2·13	2·25	1·88	1·88	1·93	2·13	2·23	2·07	2·34	2·35	2·48	2·25	2·20	2·20	2·43	1·86
From Jan. 1	3·14	3·84	3·44	2·97	3·07	3·25	2·72	2·72	2·67	3·08	3·18	2·98	3·30	3·29	3·50	3·13	2·94	3·04	3·37	2·92

Note.—The observations are taken at 9 a.m., except at Brixton (8 a.m.), and Croydon (Dingwall Road) and Kew (10 a.m.)

NOTES.

(February, 1889.)

The early half of the month was very rough, severe N.W. and N. gales occurring frequently, with much snow. The temperature on the 12th was extremely low, being at Beddington in the shade 8·5°, and on the grass −4·0°; and at Wallington in the shade 16·6°, and on the grass 8·5°. The rest of the month was cold and changeable, with occasional snow-showers.

Day of Month	Reigate Hill	Caterham	Marden Park	Kenley	Purley (Reedham)	Purley (Tudor C.)	Ashtead	Esher	Sutton	Carshalton	Wallington	Bedding- ton	Waddon
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·05	..	..	..	..	·03	..	..	·06	..	..	·01	..
2	..	..	·09	·04	·04	·05	·03	..	..	..	·01	·01	·01
3	..	..	..	..	..	..	..	..	..	..	..	..	..
4	..	..	..	..	..	..	..	..	..	..	..	..	..
5	..	..	..	..	..	..	..	..	..	..	..	..	..
6	·25	·35	·12	·15	·13	·16	·12	·10	·12	·11	·11	·09	·09
7	1·12	1·00	1·07	1·04	·76	·79	·49	·41	·49	·38	·71	·59	·50
8	·18	·14	·19	·25	·25	·30	·30	·63	·23	·23	·28	·25	·23
9	..	..	·01	·01	..	..	..	..	..	..	·01	..	..
10	·01	·03	·04	..	..	..	..	·01	..	..	..	..	..
11	..	..	..	..	..	..	·03	..	..	..	..	..	..
12	·06	·06	·04	·05	·06	·06	·10	·04	·03	·01	·03	·02	·02
13	..	..	..	..	..	..	..	..	..	..	..	..	..
14	..	..	..	·01	..	..	·02	..	..	..	..	..	..
15	..	..	..	..	..	..	..	..	..	..	..	..	..
16	..	..	..	..	..	..	..	..	..	..	..	..	..
17	..	..	..	..	..	·01	..	..	..	..	..	..	..
18	·01	..	..	..	·01	..	·03	..	·01	..	..	..	..
19	·24	·26	·28	·34	·31	·33	·35	·16	·40	·38	·40	·34	·31
20	..	·22	·15	·12	·19	·25	·25	·03	·24	·21	·33	·30	·30
21	·56	·10	·36	·38	·38	·30	·16	·07	·17	·10	·14	·15	·15
22	..	·15	·01	..	..	..	..	..	..	..	..	..	..
23	·02	·05	·03	·05	·04	..	·05	..	·05	·02	·03	·03	·03
24	·07	·13	·06	·12	·07	·10	·14	·16	·09	·10	·07	·06	·08
25	·14	·13	·04	·04	·06	·07	·10	·03	·07	·01	·06	·06	·05
26	..	..	..	·05	..	·02	·03	..	..	·01	..	..	·02
27	..	..	·02	..	..	..	..	..	..	..	..	..	..
28	·03	·05	·03	·05	·05	·05	·08	..	·06	·04	·04	·04	·04
29	..	·11	·01	..	..	·02	..	..	..	..	..	..	..
30	·18	..	·08	·11	·11	·10	·20	·12	·10	·09	·11	·10	·12
31	·04	·01	·03	..	·02	·02	·06	·02	·04	·01	·02	·01	·01
Total	2·96	2·79	2·66	2·81	2·48	2·66	2·54	1·78	2·16	1·70	2·35	2·06	1·96
From Jan. 1	8·23	7·13	6·35	6·75	6·22	6·66	6·36	4·42	5·30	4·82	5·77	5·10	4·99

Day of Month	Croydon (Brim. Bn.)	Croydon (Ding. Rd.)	Croydon (Nant. H.)	Addis- combe	Addington (Park Fm.)	Addington (Hare's B.)	West Wickham	Hayes Common	Keston (Bradfield)	Keston (Heathfld.)	Keston (Kes. Tow.)	Orpington
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	·01	..	..	..	..	..	·01	..	·01	..	..
2	..	·01	·03	·03	·06	·07	·05	·03	·03	·03	·02	..
3	..	..	..	..	..	..	..	..	..	·01	..	..
4	..	..	..	..	..	..	..	..	..	..	..	..
5	..	..	..	..	..	..	..	..	..	·01	..	..
6	·06	·10	·10	·12	·10	·09	·04	·11	·08	·10	·09	·12
7	·45	·56	·61	·59	·70	·79	·90	·63	·63	·84	·81	·70
8	·22	·25	·29	·29	·30	·27	·27	·26	·19	·26	·25	·22
9	..	..	..	..	..	..	..	..	..	·01	..	..
10	..	..	..	..	..	·01	·03	·01	·01	·02	·01	·04
11	..	..	..	..	..	..	..	..	..	·01	..	..
12	..	·02	·02	·03	·05	·06	·04	·03	·03	·04	·03	·01
13	..	..	..	..	..	..	..	..	..	·01	..	..
14	..	..	..	..	..	..	..	..	..	..	..	..
15	..	..	..	..	..	..	..	..	..	..	..	..
16	..	..	..	..	..	..	..	..	..	..	..	..
17	..	..	..	·01	..	..	..	..	..	·01	..	..
18	..	..	..	..	..	·01	..	..	..	..	..	..
19	·34	·39	·35	·25	·27	·29	·40	·34	·28	·38	·34	·35
20	·29	·30	·19	·26	·19	·17	·21	·18	·14	·19	·18	·24
21	·06	·12	·23	·23	·27	·24	·24	·23	·34	·29	·31	·22
22	..	..	..	..	..	..	..	..	..	·01	..	..
23	·06	·02	·02	·03	·03	·03	·02	·04	·02	·04	·03	..
24	..	·11	·05	·06	·03	·06	·07	·05	·04	·06	·05	·05
25	·06	..	·07	·06	·09	·07	·08	·07	·06	·06	·08	·04
26	..	..	..	..	..	..	..	·01	·01	·02	..	..
27	..	..	..	..	..	..	..	..	..	..	..	..
28	·04	·05	·06	·06	·05	·06	·04	·04	·04	·05	·04	·05
29	..	..	..	..	..	..	..	..	..	..	..	..
30	·10	·11	·11	·11	·11	·11	·11	·10	·10	·09	..	·07
31	..	·01	..	..	·07	·05	·10	·12	·06	·05	·14	·08
Total	1·68	2·06	2·13	2·13	2·32	2·38	2·60	2·26	2·06	2·60	2·38	2·19
From Jan. 1	4·36	5·38	5·52	5·50	5·92	5·93	6·14	5·92	5·50	6·36	6·37	6·00

Day of Month	Chislehurst	Bickley	Beckenham	Wimbledon (Sew. Wks.)	Wimbledon (Mt. Ararat)	Raynes Park	N. Malden (Gos. L.)	N. Malden (Sew. Wks.)	Surbiton	Kingston	Richmond	Kew	Brixton	West Norwood	Sydenham	Forest Hill	Deptford	Greenwich	Eltham	Wilmington
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	·01	..	..	..	..	..	..	..	·01	·01	..	..	..	..	..	..	..	·02	·03
2	..	·02	..	·03	·06	·04	..	..	·02	·21	·01	·01	·03	·02	·02	..	..	..	·02	·02
3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
4	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
6	·16	·09	·08	·07	·10	·09	·08	·08	·09	·10	·15	·15	·06	·06	·06	·04	·06	·09	·07	·05
7	·40	·38	·41	·24	·24	·30	·31	·30	·37	·38	·32	·30	·35	·31	·36	·13	·28	·29	·37	·33
8	·20	·22	·22	·16	·17	·20	·18	·18	..	·21	·20	·20	·19	·20	·23	·44	·16	·16	·16	·12
9	..	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..
10	..	·01	..	..	..	..	..	..	..	·01	·01	..	..	..	..	..	..	..	·01	·03
11	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	..	..	..
12	·03	·05	·02	·02	·03	·02	·03	·02	·04	·03	·01	·01	·03	·03	·03	·03	·03	·05	·03	..
13	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
14	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
15	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
16	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..
17	..	..	..	..	..	·01	..	..	..	..	·01	·01	·02	..	..	..	..	..	·02	..
18	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
19	·23	·26	·22	·18	·21	·25	·20	·19	·21	·19	·14	·13	·20	·21	·21	·02	·13	·15	·24	·30
20	·22	·21	·32	·24	·10	·24	·17	·18	·23	·24	·19	·24	·22	·22	·19	·19	·22	·23	·33	·27
21	·10	·21	·15	·15	·31	·13	·10	·12	·07	·09	·06	·03	·22	·12	·21	·40	·14	·15	·18	·18
22	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
23	·03	·03	·04	·05	·04	·05	..	..	·03	·01	·04	·04	·04	·04	·03	·04	·02	·02	·03	·05
24	·03	·04	·03	·05	·03	·05	·08	·07	·07	·10	·06	·07	·01	·03	·03	..	·02	·01	·03	·01
25	·05	·07	·05	·04	·06	·05	·07	·07	·10	·09	·01	..	·05	·04	·06	·10	·03	·03	·03	·03
26	·01	..	..	..	..	·01	..	..	·01	·01	·01	·01	·01	..	·01	..	·01	..	..	·02
27	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
28	·04	·06	·03	·03	·05	·05	·03	·04	·03	·05	·05	·04	·04	·05	·01	..	·02	·02	·05	·01
29	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·05
30	·07	·10	·09	·10	·12	·12	..	..	·09	·11	·08	·07	·09	·10	·06	·05	·08	·09	·10	·37
31	·06	·07	·04	·02	·06	·04	·19	·17	·07	·17	·06	·04	..	..	·09	·10	·01	·02	·09	..
Total	1·63	1·83	1·70	1·38	1·58	1·66	1·44	1·42	1·43	2·01	1·42	1·36	1·56	1·43	1·61	1·54	1·21	1·31	1·78	1·87
From Jan. 1	4·77	5·67	5·14	4·35	4·65	4·91	4·16	4·14	4·10	5·09	4·60	4·34	4·86	4·72	5·11	4·67	4·15	4·35	5·15	4·79

Note.—The observations are taken at 9 a.m., except at Brixton (8 a.m.), and Croydon (Dingwall Road) and Kew (10 a.m.)

NOTES.
(March, 1889.)

The month was very cold at first, with N.E. and E. winds, accompanied with snow and sleet. The fall of snow on the 2nd was more than twice as much at Kingston than elsewhere. The wind veered later on to the S.W., with heavy rains on the 7th. Another spell of rain and snow occurred from the 19th to 21st, the wind backing S.E. to N.E. The rest of the month was showery, with W. winds veering to N.W. The percentage of sunshine at Kew was 23, being 6 below the average of the past 12 years.

Daily Rainfall. April, 1889.

Day of Month	ReigateHill	Caterham	Marden Park	Kenley	Purley (Reedham)	Purley (Tudor C.)	Ashtead	Esher	Sutton	Carshalton	Wallington	Bedding-ton	Waddon	Croydon (Brim. Bn.)	Croydon (Ding. Rd.)	Croydon (Nant. H.)	Addis-combe	Addington (Park Fm.)	Addington (Hare's B.)	West Wickham	Hayes Common	Keston (Bradfield)	Keston (Heathfld.)	Keston (Kes. Tow.)	Orpington
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	..	..	·05	·04	·05	..	..	..	·03	·04	·02	·03	..	·01	·02	·01	..	·01	·01	·03	·03	·03	·04	·03
2	..	·02	·02	..	..	·01	·07	..	·02	..	..	..	..	..	..	..	..	..	..	..	..	·11	..	..	..
3	·31	·24	·21	·15	·14	·14	·18	·16	·11	·09	·13	·10	·11	·10	·12	·13	·13	·13	·12	·14	·13	·04	·13	·12	·12
4	·04	·10	·07	·05	·05	·03	·21	..	·16	·10	·08	·07	·06	·06	·06	·05	·04	·04	·05	·03	·06	·03	·04	·03	..
5	·10	·07	·02	·02	..	·01	·08	·04	..	·01	·02	·04	·05	·04	·01	..	·01	..	..	·01	·03	·02	·02	..	..
6	·02	..	..	..	..	..	·05	..	·02	..	..	..	..	..	..	·01	..	..	..	..	..	..	..	..	..
7	..	..	..	..	·02	..	·05	..	·02	·01	·01	·01	·01	·02	..	·01	·01	·03	..	·03	·02	·02	·03	·03	·04
8	·19	·13	·11	·09	·10	·10	·20	·17	·11	·10	·09	·09	·09	·06	·11	·10	·09	·05	·09	·05	·08	·07	·09	·08	..
9	·37	·33	·24	·30	·29	·28	·38	·22	·25	·31	·29	·27	·28	·31	·42	·36	·45	·38	·32	·49	·74	·93	·91	·64	·52
10	·20	·29	·29	·33	·33	·40	·19	·12	·28	·24	·34	·29	·28	·30	·22	·26	·25	·30	·28	·38	·20	·23	·23	·23	·22
11	..	..	·01	·02	·01	·02	·05	·03	·02	·01	·01	·01	·01	..	..	·01	·01	·01	..	·01	·01	..	·01	..	..
12	·12	·20	·15	·16	·18	·19	·15	·07	·13	·13	·15	·15	·17	·15	·19	·22	·21	·21	·18	·25	·24	·25	·24	·26	·21
13	·26	·15	·20	·18	·22	·20	·17	·10	·15	·15	·17	·15	·16	·12	·18	·18	·18	·20	·18	·20	·18	·20	·19	·19	·20
14	·04	·05	·03	·05	·04	·04	·04	·04	·02	·01	·03	·02	·02	·02	·01	·02	·02	·02	·03	·04	·02	·03	·04	·04	·02
15	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..
16	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
17	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..
18	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
19	..	·02	·02	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..
20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
21	·04	·01	·01	·02	·02	·01	·06	..	·03	·01	·01	·01	..	..	..	·01	·01	..	·01	..	..	..	·01	·02	..
22	·05	·02	·02	·03	·04	·05	·21	·05	·08	·12	·09	·08	·06	·10	·04	·05	·05	·03	·02	·03	·01	·02	·03	·03	..
23	·21	·23	·18	·21	·14	·15	·17	·25	·15	·13	·14	·12	·12	·13	·12	·14	·14	·15	·17	·23	·13	·13	·19	·16	·16
24	·24	·20	·12	·24	·26	·24	·15	·12	·17	·16	·18	·16	·14	·14	·17	·19	·18	·25	·20	·25	·26	·20	·24	·23	·25
25	·02	·18	·37	·10	·05	·10	·04	..	·01	·01	..	..	·01	..	·01	·04	·05	·17	·18	·17	·16	·08	·08	·09	·23
26	·27	..	·20	·17	·15	·15	·19	·11	·11	·11	·13	·12	·11	·07	·11	·13	·13	·13	·14	·16	·14	·12	·14	·14	·12
27	·14	·25	·20	·09	·11	·12	·13	·03	·05	·05	·04	·06	·08	·07	·10	·08	·08	·04	·05	·08	·07	·09	·10	·10	·11
28	·09	·19	·10	·14	·09	·08	·12	·15	·07	·07	·10	·07	·06	·06	·03	·09	·19	·12	·06	·13	·06	·06	·08	·05	·05
29	·02	·01	·01	..	·01	·03	..	·01	..	·03	·02	·01	·02	..	·02	·02	·02	·01	·02	·01	·03	·01	·05	·01	..
30	·31	·22	·17	·25	·19	·19	·24	·27	·23	·12	·14	·16	·16	·14	·12	·13	·13	·17	·18	·20	·14	·12	·12	·12	·14
Total	3·04	2·91	2·75	2·65	2·48	2·59	3·13	1·94	2·19	2·00	2·21	2·01	2·03	1·89	2·05	2·25	2·39	2·44	2·29	2·90	2·74	2·79	3·03	2·61	2·42
From Jan. 1	11·27	10·04	9·10	9·40	8·70	9·25	9·49	6·36	7·49	6·82	7·98	7·11	7·02	6·25	7·43	7·77	7·89	8·36	8·22	9·04	8·66	8·29	9·39	8·98	8·42

Daily Rainfall. April, 1889.

Day of Month	Chislehurst	Bickley	Becken-ham	Wimbledon (Sew. Wks.)	Wimbledon (Mt. Ararat)	Raynes Park	N. Malden (Gos. L.)	N. Malden (Sew. Wks.)	Surbiton	Kingston	Richmond	Kew	Brixton	West Norwood	Sydenham	Forest Hill	Deptford	Greenwich	Eltham	Wilming-ton
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·01	·03	·03	·04	·03	·04	..	..	..	·01	·04	·02	·02	..	·03	·03	..	·01	·02	·03
2	..	..	..	..	..	·01	..	..	·02	·02	·01	·01	..	..	..	..	..	..	..	..
3	·14	·14	·13	·14	·12	·13	·10	·08	·11	·13	·14	·14	·15	·14	·16	·15	·13	·15	·13	·14
4	·03	·06	·06	·03	·04	·05	·03	·03	..	·02	·06	·05	·02	·06	·10	·13	·01	·02	·07	..
5	..	..	..	..	·02	·02	..	..	..	·01	·01	·01	..	..	..	..	..	..	·01	..
6	..	..	..	..	..	..	·04	·04	·02	·07	·01	·04	..	..	·01	..	..	..	..	..
7	·08	·05	·03	·02	·01	·01	..	..	·02	·02	·02	·01	·01	·02	·01	·03	·04	·04	·03	..
8	·08	·08	·06	·06	·08	·09	·07	·08	·07	·02	·15	·15	·04	·06	·05	·04	·04	·06	·09	·14
9	·33	·31	·37	·50	·33	·29	·28	·29	·31	·15	·48	·43	·30	·40	·35	·31	·15	·15	·14	·05
10	·23	·25	·22	·30	·31	·28	·30	·29	·22	·23	·22	·25	·17	·19	·20	·03	·17	·18	·25	·22
11	..	·02	·01	..	..	..	..	..	·02	·01	..	·01	..	·01	·01	..	..	..	..	..
12	·18	·26	·20	·09	·10	·10	·08	·09	·08	·08	·06	·04	·09	·13	·17	·02	·09	·11	·25	·18
13	·17	·17	·15	·13	·18	·17	·16	·16	·15	·17	·13	·12	·10	·13	·15	·27	·10	·11	·15	·17
14	·01	·03	·01	·01	·01	·02	..	·01	·02	·02	·02	·01	·02	·02	·01	·05	..	·01	·02	·01
15	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..
16	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
17	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
18	..	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..
19	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
20	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	·01	..	..	..	..	..
21	..	..	·01	·03	·04	·04	·04	·05	·03	·03	·03	·03	·03	·03	..	·04	·02	·03	·02	..
22	·01	·02	·08	·06	·04	·04	..	..	·01	·02	·04	·02	·10	·08	·10	·06	·09	·05	·08	..
23	·13	·14	·13	·22	·22	·23	·19	·19	·27	·42	·33	·29	·40	·26	·21	·26	·32	·31	·23	·10
24	·21	·20	·12	·18	·17	·16	·11	·10	·09	·16	·21	·18	·23	·17	·22	·20	·22	·19	·14	·30
25	·05	·14	·15	·02	·03	·03	·03	·03	·02	·02	·01	·01	·01	..	·01	..	·02	·05	·06	·15
26	·16	·16	·15	·12	·12	·13	·11	·10	·10	·14	·12	·11	·14	·14	·15	·27	·12	·13	·17	·17
27	·10	·11	·06	·07	·05	·05	·10	·10	·07	·08	·08	·10	·07	·09	·14	·04	·10	·12	·13	·18
28	·07	·06	·04	..	·06	·07	·01	·02	·08	·10	·12	·06	·06	·05	·02	·02	·01	·04	·05	·05
29	..	·02	·01	..	..	·02	..	..	..	·01	·03	·03	·01	·01	·04	..	..	..	·01	..
30	·22	·13	·11	·11	·22	·23	·11	·10	·10	·10	·11	·10	·16	·13	·05	·12	·05	·09	·20	·10
Total	2·21	2·38	2·13	2·13	2·18	2·22	1·76	1·76	1·81	2·04	2·43	2·23	2·13	2·12	2·20	2·07	1·68	1·85	2·26	1·99
From Jan. 1	6·98	8·05	7·27	6·48	6·83	7·13	5·92	5·90	5·91	7·13	7·03	6·57	6·99	6·84	7·31	6·74	5·83	6·20	7·41	6·78

Note. — The observations are taken at 9 a.m., except at Brixton (8 a.m.), and Croydon (Dingwall Road) and Kew (10 a.m.)

NOTES.

(April, 1889.)

The most genial April for several years, especially as regards the absence of frost and cutting east winds. Temperature was nevertheless rather below the average for April for the 20 years, 1861—80. The weather was showery, and the rainfall slightly above the average. The percentage of bright sunshine at Kew was 22, being 10 below the average of the past 12 years. The Cuckoo and Nightingale were heard at Beddington on the 19th.

Daily Rainfall. May, 1889.

Day of Month	Reigate Hill	Caterham	Marden Park	Kenley	Purley (Reedham)	Purley (Tudor C.)	Ashtead	Esher	Sutton	Carshalton	Wallington	Bedding-ton
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·09	·14	·10	·13	·09	·08	·15	·08	·10	·07	·06	·05
2	·18	·10	·09	·11	·14	·15	·05	·18	·19	·06	·09	·18
3	..	..	..	..	..	..	..	..	..	..	..	..
4	·01	..	·02	..	..	·02	..	..	..	..	..	..
5	..	·02	·27	·04	·03	·06	·02	..	·02	..	..	·08
6	..	..	..	..	..	..	..	..	..	..	..	..
7	..	..	..	..	..	..	..	..	..	..	..	..
8	..	..	..	·02	..	·02	..	..	..	..	..	..
9	·18	·34	·30	·30	·31	·27	·20	·12	·32	·25	·28	·28
10	..	..	..	..	..	·02	..	..	..	..	..	..
11	·21	·18	·15	·22	·20	·20	·23	·20	·20	·20	·22	·22
12	·19	·15	·12	·10	·09	·08	·18	·07	·15	·13	·13	·10
13	..	..	·01	..	..	..	..	..	..	·01	..	..
14	..	..	..	..	..	..	..	..	..	..	..	..
15	..	..	..	..	..	..	..	..	..	..	..	..
16	..	..	..	..	..	..	..	..	..	..	..	..
17	..	..	..	..	..	..	..	..	..	..	..	..
18	..	..	..	..	..	..	..	..	..	..	..	..
19	·20	·14	·15	·15	·15	·15	·19	·11	·23	·20	·20	·17
20	..	..	..	..	..	..	..	..	..	·01	..	..
21	..	..	..	..	..	..	..	..	..	..	..	..
22	..	..	..	..	..	..	..	..	..	..	..	..
23	..	..	..	..	..	..	..	..	..	..	..	..
24	..	..	..	..	..	..	·03	..	·02	·02	..	..
25	·55	·49	·49	·46	·51	·47	·78	·10	·29	·38	·54	·59
26	·90	·72	·71	·81	·79	·87	1·67	1·52	1·24	1·22	·93	1·03
27	·31	·22	·12	·21	·30	·23	·26	·19	·32	·28	·33	·28
28	·21	·11	·12	·26	·15	·15	·11	·07	·11	·13	·14	·14
29	·19	·06	·07	·12	·21	·25	·05	·01	·05	·07	·08	·11
30	·01	..	..	..	·01	·02	..	..	·05	..	..	·02
31	..	..	..	..	..	..	..	..	..	..	..	..
Total	3·23	2·67	2·72	2·93	2·98	3·04	3·92	2·65	3·29	3·03	3·00	3·25
From Jan. 1	14·50	12·71	11·82	12·33	11·68	12·29	13·41	9·01	10·78	9·85	10·98	10·36

Day of Month	Waddon	Croydon (Brim. Bn.)	Croydon (Ding. Rd.)	Croydon (Nant. H.)	Addis-combe	Addington (Park Fm.)	Addington (Hare's B.)	West Wickham	Hayes Common	Keston (Bradfield)	Keston (Heathfd.)	Keston (Kes. Tow.)	Orpington
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·07	·04	·05	·05	·04	·06	·06	·04	·04	·04	·05	·04	·05
2	·19	·17	·03	·08	·08	·20	·29	·18	·13	·12	·14	·13	·17
3	..	..	..	..	..	..	..	..	..	..	·01	..	..
4	..	..	·01	·02	·02	..	..	..	..	..	·01	..	..
5	·12	·12	·12	·12	·09	·03	·03	·01	..	..	·01	·01	..
6	..	..	..	..	..	..	..	..	..	..	..	..	..
7	..	..	..	..	..	..	..	..	..	..	..	..	..
8	·01	..	·01	·01	·01	..	·01	..	·01	·03	·03	·02	·05
9	·27	·26	·27	·26	·22	·23	·24	·24	·29	·27	·30	·30	·29
10	..	..	..	..	..	..	..	·03	·01	..	·01	..	..
11	·22	·21	·25	·26	·27	·23	·24	·24	·24	·18	·09	·22	·17
12	·10	·09	·11	·13	·12	·13	·09	·10	·10	·07	·22	·08	·07
13	..	..	..	..	..	..	..	·01	·01	..	·01	..	..
14	..	..	..	..	..	..	..	..	..	..	..	..	..
15	..	..	..	..	..	..	..	..	..	..	..	..	..
16	..	..	..	..	..	..	..	..	..	..	..	..	..
17	..	..	..	..	..	..	..	..	..	..	..	..	..
18	..	..	..	·01	..	..	..	..	..	..	..	..	..
19	·15	·16	·19	·17	·17	·21	·21	·17	·16	·18	·18	·16	·11
20	..	..	..	..	..	..	..	..	..	..	·01	..	..
21	..	..	..	..	..	..	..	..	..	..	..	..	..
22	..	..	..	..	..	..	..	..	..	..	..	..	..
23	..	..	·03	·01	·01	..	..	..	·03	..	..	..	..
24	..	..	..	..	..	..	..	..	..	..	·01	..	..
25	·57	·59	·61	·54	·53	·60	·56	·56	·58	·54	·48	·50	·38
26	·95	·95	·94	·78	·76	·45	·53	·50	·40	·36	·41	·35	·12
27	·26	·30	·08	·24	·23	·37	·23	·31	·28	·29	·26	·29	·64
28	·14	·15	·15	·12	·12	·10	·14	·11	·10	·08	·10	·09	·04
29	·14	·12	·09	·20	·20	·06	·03	·09	·04	·04	·06	·03	·14
30	..	..	..	·01	·01	..	..	..	·01	..	..	..	..
31	..	..	..	..	..	..	..	..	..	..	..	..	..
Total	3·19	3·16	2·94	3·01	2·88	2·67	2·66	2·59	2·43	2·20	2·39	2·22	2·23
From Jan. 1	10·21	9·41	10·37	10·78	10·77	11·03	10·88	11·63	11·09	10·49	11·78	11·20	10·65

Daily Rainfall.

Day of Month	Chislehurst	Bickley	Beckenham	Wimbledon (Sew. Wks.)	Wimbledon (Mt. Ararat)	Raynes Park	N. Malden (Gos. L.)	N. Malden (Sew. Wks.)	Surbiton	Kingston	Richmond	Kew	Brixton	West Norwood	Sydenham	Forest Hill	Deptford	Greenwich	Eltham	Wilmington
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·03	·04	·04	·06	·06	·08	·04	·04	·08	·08	·11	·09	·03	·03	·05	·14	·03	·04	·03	·02
2	·18	·17	·16	·24	·30	·27	·18	·18	·24	·34	·21	·24	·45	·24	·18	·30	·39	·51	·18	·03
3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
4	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	·01	..	..	..	..	..
5	·04	..	..	·03	·01	·02	·02	·02	..	·02	·04	·03	·01	·02	·03	·03	·05	·12	·18	·04
6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
7	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
8	·09	·02	·01	..	..	..	..	..	..	·01	..	..	..	·02	·01	·05	..	·01	·06	·04
9	·35	·32	·27	·21	·25	·25	·18	·18	·21	·25	·21	·23	·25	·23	·27	·25	·30	·35	·40	·35
10	·01	..	..	..	..	..	·04	·04	..	..	·02	..	·03	..	·01	..	..	..	·02	·01
11	·23	·23	·25	·21	·26	·25	·27	·27	·20	·26	·30	·31	·23	·28	·40	·15	·27	·35	·36	·27
12	·14	·14	·11	·08	·12	·11	·10	·10	·10	·11	·06	·05	·08	·11	·12	·20	·05	·06	·16	·09
13	..	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	·01	·01	..
14	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
15	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
16	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
17	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
18	..	..	..	·02	·03	·02	..	..	..	·01	·03	·01	·01	·01	..	·02	..	·01	..	..
19	·18	·28	·20	·19	·18	·18	·17	·14	·12	·12	·11	·10	·20	·22	·19	·18	·20	·24	·20	·14
20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
21	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
22	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	..	..	..
23	·03	·05	·03	..	..	..	..	..	..	..	..	·01	..	·01	..	..	·14	·19	·05	·18
24	..	..	·01	·02	·01	·01	·06	·06	..	..	..	·01	·03	·01	·01	·01	·01	·01	..	..
25	1·13	·60	·43	·75	·68	·72	·74	·97	·64	·43	·16	·09	·90	·58	·42	·54	·45	·36	·64	·17
26	·47	·55	·52	1·31	1·09	1·14	1·30	1·30	1·44	1·48	1·36	1·51	·81	·98	·68	·35	·52	·54	·62	·31
27	·36	·19	·25	·29	·45	·30	·25	·14	·23	·22	·19	·14	·50	·23	·23	·52	·28	·31	·33	·32
28	·06	·08	·09	·07	·07	·08	·07	·06	·07	·07	·09	·08	·08	·13	·11	·11	·13	·14	·13	·05
29	·02	·04	·24	·06	·07	·08	·06	·05	·05	·03	·04	·13	·04	·02	·06	·04	·02	·05	·18	·04
30	..	..	..	..	..	..	..	..	..	·03	·02	·01	·01	·01	..	..	..	..	..	..
31	..	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Total	3·32	2·71	2·61	3·54	3·58	3·53	3·48	3·55	3·38	3·46	2·95	3·05	3·66	3·14	2·78	2·89	2·84	3·30	3·55	2·06
From Jan. 1	10·30	10·76	9·88	10·02	10·41	10·66	9·40	9·45	9·29	10·59	9·98	9·62	10·65	9·98	10·09	9·63	8·67	9·50	10·96	8·84

Note. — The observations are taken at 9 a.m., except at Brixton (8 a.m.), and Croydon (Dingwall Road and Kew (10 a.m.).

NOTES.

(May, 1889.)

Many of the days were bright and very warm, others dull and cold. Thunderstorms were frequent. At Denbies, Dorking, the rainfall on the 26th was 1·75 in., and at Kew 1·10 in. fell between 6 a.m. and noon on 27th, and of this ·65 in. fell between 6.50 and 7.50 a.m. At Kew, bright sunshine was 8 per cent. below the average.

Daily Rainfall. June, 1889.

Day of Month	Reigate Hill	Caterham	Marden Park	Kenley	Purley (Reedham)	Purley (Tudor C.)	Ashtead	Esher	Sutton	Carshalton	Wallington	Beddington	Waddon	Croydon (Brim. Bn.)	Croydon (Ding. Rd.)	Croydon (Nant. H.)	Addiscombe	Addington (Park Fm.)	Addington (Hare's B.)	West Wickham	Hayes Common	Keston (Bradfield)	Keston (Heathfld.)	Keston (Kes. Tow.)	Orpington
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
2	..	..	..	..	..	..	..	·02	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
4	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..
6	..	..	..	..	..	..	..	..	·05	·03	·01	..	..	·02	·06	·09	·24	·25	·09	·48	·65	·75	·66	·53	·40
7	·09	·04	·02	·02	·02	·04	·05	·02	·01	·03	·03	·04	·04	·05	·04	·04	·05	·03	·03	·07	·09	·41	·51	·89	·36
8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..
9	·56	·58	·64	·60	·61	·58	·65	·14	·56	·64	·65	·67	·66	·70	·84	·79	·80	·75	·72	·85	·85	·87	·91	·97	·78
10	·36	·38	·34	·37	·47	·45	·30	·18	·29	·31	·38	·37	·30	·41	·30	·48	·51	·58	·39	·55	·58	·55	·62	·67	·81
11	·03	·01	·01	·02	·02	·03	·05	·07	·02	·01	·01	..	·01	..	·01	·01	..	..	·01	·01	..	·01	·02	..	..
12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
13	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
14	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
15	·06	..	·03	·03	·04	·03	·06	·02	·05	·14	·10	·05	·04	·05	·05	·05	·03	·01	·02	·03	·05	·03	·05	·04	..
16	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..
17	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
18	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
19	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
21	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
22	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
23	..	..	..	..	..	..	..	..	..	..	..	·01	·01	..	·02	..	..	..	..	..	..	..	..	..	..
24	..	..	..	..	..	·01	..	..	·02	·02	·04	·03	·03	..	..	·01	·01	..	..	..	..	..	·02	..	..
25	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
26	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
27	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
28	..	..	..	..	..	..	..	..	..	·02	..	·07	·15	·27	·08	·04	·04	..	..	..	..	..	..	..	..
29	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
30	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Total	1·10	1·01	1·04	1·04	1·16	1·14	1·11	0·45	1·00	1·20	1·22	1·24	1·24	1·50	1·40	1·51	1·68	1·62	1·26	1·99	2·22	2·62	2·82	3·10	2·35
From Jan. 1	15·60	13·72	12·86	13·37	12·84	13·43	14·52	9·46	11·78	11·05	12·20	11·60	11·45	10·91	11·77	12·29	12·45	12·65	12·14	13·62	13·31	13·11	14·60	14·30	13·00

Daily Rainfall. June, 1889.

Day of Month	Chislehurst	Bickley	Beckenham	Wimbledon (Sew. Wks.)	Wimbledon (Mt. Ararat)	Raynes Park	N. Malden (Gos. L.)	N. Malden (Sew. Wks.)	Surbiton	Kingston	Richmond	Kew	Brixton	West Norwood	Sydenham	Forest Hill	Deptford	Greenwich	Eltham	Wilmington
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
4	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
6	·17	·30	·42	·17	·13	·08	·12	·12	..	·02	·30	·38	·56	·51	·53	·51	·13	·23	·22	·25
7	·20	·14	·04	·04	·02	·03	·05	·05	·04	·04	·04	·03	·06	·07	·09	·10	·08	·08	·44	·02
8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
9	·31	1·05	·91	·67	·61	·59	·57	·57	·48	·43	·27	·22	·84	·88	1·02	·97	·85	·88	1·08	·85
10	·75	·76	·52	·37	·42	·33	·30	·30	·19	·21	·24	·20	·49	·53	·52	·56	·48	·53	·64	·52
11	..	..	..	·02	·02	·02	·02	·02	·01	·02	·02	·01	·01	·01	..	..	..	..	..	..
12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
13	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
14	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
15	·07	·06	·07	·26	·14	·11	·07	·07	·06	·07	·43	·43	·20	·18	·11	·09	·26	·33	·19	·04
16	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
17	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
18	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
19	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
21	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
22	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
23	..	..	·02	..	..	..	·02	·02	..	..	..	·01	..	..	·05	..	·02	..	·01	..
24	..	..	..	·03	·02	·03	..	..	..	·01	·01	..	·02	·02	..	·04	..	·02	..	..
25	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
26	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
27	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
28	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·08	..	..	..	..	..
29	..	·04	·38	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·12	..
30	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Total	1·50	2·35	2·36	1·56	1·36	1·19	1·15	1·15	0·78	0·80	1·31	1·28	2·18	2·20	2·40	2·27	1·82	2·07	2·70	1·68
From Jan. 1	11·80	13·11	12·24	11·58	11·77	11·85	10·55	10·60	10·07	11·39	11·29	10·90	12·83	12·18	12·49	11·90	10·49	11·57	13·66	10·52

Note.—The observations are taken at 9 a.m., except at Brixton (8 a.m.), and Croydon (Dingwall Road) and Kew (10 a.m.).

NOTES.

(June, 1889.)

Weather very changeable during the earlier part of the month, sometimes hot, and at other times very cold for the time of year, especially on the 10th. It was finer after the 15th, with anti-cyclonic conditions, and easterly and northerly winds. A severe thunderstorm occurred on the 6th, with vivid lightning. The percentage of sunshine at Kew was 40, which is about the average.

Daily Rainfall. July, 1889.

Day of Month	Reigate Hill	Caterham	Marden Park	Kenley	Purley (Reedham)	Purley (Tudor C.)	Ashtead	Esher	Sutton	Carshalton	Wallington	Bedding-ton	Waddon	Croydon (Brim. Bn.)	Croydon (Ding. Rd.)	Croydon (Nant. H.)	Addis-combe	Addington (Park Fm.)	Addington (Hare's B.)	West Wickham	Hayes Common	Keston (Bradfield)	Keston (Heathfld.)	Keston (Kes. Tow.)	Orpington
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
4	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
7	·01	..	·01	·01	·03	..	·06	..	·05	·05	·04	·03	·04	..	..	·04	·04	..	·02	..	·02	·07	·03	..	..
8	·04	..	·01	·10	·09	·12	·15	·11	·10	·09	·09	·08	·08	·11	·12	·11	·10	·10	·07	·09	·07	·08	·07	·10	·08
9	·17	·49	·37	·33	·35	·31	·08	·02	·12	·13	·19	·23	·27	·25	·35	·39	·38	·21	·22	·37	·26	·28	·31	·29	·42
10	·20	·12	·17	·21	·21	·23	·14	·07	·09	·08	·14	·15	·14	·15	·17	·19	·19	·17	·16	·17	·14	·15	·15	·16	..
11	..	·03	..	..	..	·01	·04	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	·01	..	·16
12	·01	·01	·01	·18	·18	·20	·07	..	·25	·14	·25	·18	·15	·16	·13	·18	·15	1·17	1·12	·76	1·28	·96	·80	·86	·22
13	..	..	·01	·08	..	·02	..	..	..	..	..	..	..	..	·01	·02	·02	·01	..	..	..	·01	·03	..	·27
14	·31	·06	·05	·04	·06	·06	·13	·14	·10	·01	..	·18	·14	·11	·02	·04	·03	·07	·19	·16	·09	·06	·06	·10	·23
15	·06	·03	·02	·01	·01	·02	·06	·01	·05	·06	·08	·07	·05	·07	·07	·05	·06	·01	·01	·01	·01	..	·02	..	..
16	·53	·54	·47	·34	·24	·34	·28	·11	·25	·21	·28	·26	·25	·23	·23	·26	·25	·29	·29	·34	·28	·28	·29	·28	·27
17	·12	·60	·54	·70	..	·56	·12	·04	·31	·67	·66	·41	·36	·26	·51	·58	·65	·37	·38	·34	·31	·26	·28	·25	·25
18	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..
19	..	..	..	..	·01	..	·02	..	·04	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
20	·11	..	·07	·08	·09	·06	·01	·03	..	·04	·04	·04	·04	·05	·04	·07	·07	·04	·06	·05	·04	·04	·06	·01	·03
21	·01	..	·02	·19	·24	·45	·95	·92	·80	·89	·68	·74	·73	·79	·77	·54	·57	·39	·33	·36	·37	·31	·36	·36	·34
22	..	..	..	..	..	·30	..	·02	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..
23	·09	·07	·05	·29	·35	·10	·48	·04	·26	·23	·16	·12	·10	·12	·10	·10	·09	·09	·14	·12	·08	·06	·07	·07	·05
24	·12	·11	·06	·10	·10	·01	·10	·03	·04	·09	·03	·03	·03	·04	·05	·04	·03	·08	·09	·09	·06	·07	·09	·11	·10
25	·03	·04	·04	..	·02	..	..	·02	..	..	..	..	..	..	..	..	..	..	..	·01	·01	..	·02	..	..
26	·85	·23	·13	·22	·30	·26	·08	·05	·14	·23	·30	·25	·20	·17	·15	·15	·12	·09	·08	·08	·06	·07	·07	·07	·10
27	·02	·25	·11	·18	·20	·20	·13	·01	·35	·38	·30	·18	·18	·22	·21	·21	·22	·23	·25	·21	·19	·20	·16	·07	·06
28	..	·01	·01	·01	·01	·01	..	..	..	·01	..	·01	·01	..	·01	·01	·01	..	·01	·02	·01	·02	·03	·02	·02
29	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
30	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
31	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Total	2·68	2·59	2·15	3·07	2·50	3·26	2·93	1·62	2·95	3·31	3·24	2·97	2·77	2·73	2·94	2·93	2·98	3·32	3·42	3·19	3·28	2·92	2·92	2·78	2·60
From Jan. 1	18·28	16·31	15·01	16·44	15·34	16·69	17·45	11·08	14·73	14·36	15·44	14·57	14·22	13·64	14·71	15·27	15·43	15·97	15·56	16·81	16·59	16·03	17·52	17·08	15·60

Day of Month	Chislehurst	Bickley	Beckenham	Wimbledon (Sew. Wks.)	Wimbledon (Mt. Ararat)	Raynes Park	N. Malden (Gos. L.)	N. Malden (Sew. Wks.)	Surbiton	Kingston	Richmond	Kew	Brixton	West Norwood	Sydenham	Forest Hill	Deptford	Greenwich	Eltham	Wilmington
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
4	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
6	..	·15	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
7	·04	..	·02	..	..	..	..	..	·01	..	..	..	..	·01	·13	..	..	..	·03	..
8	·10	..	·09	·11	·15	·13	·08	..	·16	·15	·07	·08	·09	·12	·35	·13	·10	·15	·07	·08
9	·21	·21	·31	·13	·21	·15	·26	·13	·04	·05	·06	·06	·19	·42	..	·33	·24	·21	·17	·29
10	·12	·11	·12	..	·04	·05	..	·05	·05	·07	·08	·09	·04	·08	..	·14	·09	·11	·09	·08
11	·12	..	..	·05	·07	·09	·03	·07	·03	·05	·07	·10	·04	·10	·12	·05	·05	·06	·13	..
12	·48	·50	·14	·23	·18	·20	·06	·10	..	·04	·88	·64	·14	·11	..	·08	·19	·18	·31	·27
13	·17	·22	·04	·04	·01	..	..	..	..	..	..	..	·08	..	·04	·10	·07	·04	·09	·06
14	·14	·10	·13	..	·01	·01	·02	·06	·05	·02	..	..	·02	·01	·06	·02	·10	·16	·08	·14
15	·04	·05	·03	..	..	·02	..	..	·02	·03	·02	·02	·02	·02	·01	·10	..	·02	·02	·01
16	·26	·32	·23	·14	·19	·20	·21	·15	·15	·18	·07	·05	·06	·20	·22	·06	·09	·11	·20	·21
17	·16	·11	·20	·50	·44	·50	·19	·10	·22	·13	·24	·26	·23	·23	·15	·10	·06	·08	·30	·11
18	..	..	..	..	..	·01	..	..	..	..	..	..	..	..	·17	·01	..	..	·01	·01
19	..	..	..	..	..	..	..	..	..	..	..	·02	..	..	..	·02	..	..	..	..
20	·07	·08	·06	·02	·02	·03	.03	·02	·03	·04	·05	·03	·02	·03	·03	·03	·02	·03	·07	·05
21	·74	·75	1·01	·77	·80	·91	.93	·82	·99	·69	·38	·63	·47	·95	1·09	·22	·58	·51	1·13	·33
22	..	..	..	..	..	..	..	..	..	..	..	·06	..	..	..	..	..	..	..	..
23	·09	·12	·20	·04	·07	·10	·12	·08	·03	·04	·31	·44	·06	·20	·32	·38	·06	·10	·27	·09
24	·04	·05	·01	·07	·04	·06	·04	·03	·05	·03	·02	·06	·05	·08	·05	..	·06	·08	·05	·03
25	·02	·01	·02	·02	..	·02	·02	·12	·02	..	·01	·02	·04	·02	..	..	·02	·03	·03	·01
26	·15	·15	·06	·26	·15	·16	·10	·07	·10	·10	·06	·05	·16	·13	·09	·07	·09	·08	·13	·07
27	·11	·09	·09	·30	·53	·50	·50	·70	·32	·46	·51	·43	·20	·33	·22	·19	·10	·09	·08	·02
28	·03	·04	·02	·02	..	·01	·02	..	..	..	·01	·01	·01	·02	·01	·02	·02	·02	·03	·01
29	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
30	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
31	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Total	3·09	3·06	2·78	2·70	2·91	3·15	2·61	2·50	2·27	2·08	2·84	3·05	1·92	3·06	3·06	2·05	1·94	2·06	3·29	1·87
From Jan.1	14·89	16·17	15·02	14·28	14·68	15·00	13·16	13·10	12·34	13·47	14·13	13·95	14·75	15·24	15·55	13·95	12·43	13·63	16·95	12·39

Note.—The observations are taken at 9 a.m., except at Brixton (8 a.m.), and Croydon (Dingwall Road and Kew (10 a.m.).

NOTES.

(July, 1889.)

The month commenced with a continuation of the fine anticyclonic conditions, so prevalent in June. After the 5th an important change occurred; depressions appeared in all parts of the British Islands and the neighbourhood, and thunderstorms became very prevalent. Temperature fell to several degrees below the average. Bright sunshine recorded at Kew during the month was 8 per cent. below the average.

Daily Rainfall. August, 1889.

Day of Month	ReigateHill	Caterham	Marden Park	Kenley	Purley (Reedham)	Purley (Tudor C.)	Ashtead	Esher	Sutton	Carshalton	Wallington	Bedding-ton	Waddon	Croydon (Brim. Bn.)	Croydon (Ding. Rd.)	Croydon (Nant. H.)	Addis-combe	Addington (Park Fm.)	Addington (Hare's B.)	West Wickham	Hayes Common	Keston (Bradfield)	Keston (Heathfld.)	Keston (Kes. Tow.)	Orpington
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
2	·23	·24	·11	·20	·17	·17	·20	·07	·16	·05	·11	·11	·12	·09	..	·12	·12	·12	·18	·14	·14	·09	·14	·10	..
3	·11	·14	·07	·11	·06	·10	·12	·06	·10	·18	·10	·09	·05	·09	·18	·09	·08	·12	·10	·13	·08	·08	·09	·10	·12
4	·12	·11	·20	·09	·09	·05	·10	·05	·09	·08	·09	·09	·10	·10	·10	·09	·08	·07	·07	·11	·08	·09	·09	·10	·09
5	·15	·48	·19	·12	·05	·05	·18	·24	·03	·03	·07	·04	·06	·04	·03	·07	·05	·25	·30	·28	·33	·21	·23	·23	·35
6	·01	..	·02	·02	·01	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	..	..	·01	..	..
7	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
8	..	..	..	..	·01	..	..	..	·01	..	·01	·01	·01	..	..	·01	·01	..	..	..	..	..	..	..	..
9	·30	·31	·27	·31	·31	·35	·24	·18	·19	·17	·19	·20	·18	·20	·20	·21	·20	·25	·26	·24	·21	·17	·09	·18	·12
10	·15	·41	·32	·14	·08	·07	..	·14	·03	·04	·02	·02	·03	..	·03	·02	·01	·22	·34	·58	·31	·41	·58	·46	·16
11	·14	·12	·10	·06	·07	·08	·38	·33	·07	·04	·07	·12	·10	·16	·13	·10	·06	·10	·16	·07	·14	·06	·07	·06	·09
12	·01	·03	·02	·04	·02	·05	..	·01	·02	·02	·02	·02	·02	·01	·01	·01	·02	·05	·03	·04	·03	·04	·05	·04	·05
13	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
14	·33	·38	·34	·26	·20	·20	·18	·05	·14	·11	·13	·12	·11	·10	·12	·13	·12	·17	·19	·28	·13	·12	·17	·14	·11
15	·01	·06	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
16	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
17	·04	..	·04	..	..	·02	·07	·03	·04	·03	·05	·05	·05	·04	·06	·08	·07	..	..	..	..	..	..	..	..
18	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..
19	·68	·87	·62	·92	·83	·86	·25	·13	·57	·50	·48	·49	·55	·50	·75	·76	·71	·75	·76	·49	·65	·42	·42	·43	·32
20	·01	·01	..	·01	..	·01	..	..	..	·03	..	..	..	..	..	..	..	..	..	·04	..	..	·02	·01	..
21	·46	·17	·11	·29	·27	·30	·28	·12	·23	·23	·25	·23	·20	·23	·22	·30	·29	·19	·14	·10	·13	·06	·10	·13	·11
22	·06	·06	·05	·07	·08	·08	·10	·06	·08	·06	·06	·08	·08	·11	·10	·12	·09	·30	·28	·18	·13	·17	·19	·14	·10
23	·04	..	·01	·03	·03	·04	·08	·01	·02	·03	·03	·03	·03	·03	·03	·03	·03	·01	·02	·01	·03	·02	·03	·03	..
24	·15	·08	·09	·14	·13	·27	·12	·12	·22	·25	·19	·27	·26	·24	·24	·26	·23	·22	·20	·21	·29	·19	·20	·24	·24
25	..	..	..	..	..	..	..	..	..	·05	..	..	·01	..	·01	·01	·01	·01	·01	..	..	..	·01	..	..
26	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
27	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
28	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
29	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
30	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
31	..	..	·01	..	..	..	..	..	..	..	·01	..	..	..	..	·01	·01	..	..	..	·01	·01	·02	·01	..
Total	3·00	3·47	2·57	2·81	2·41	2·70	2·30	1·60	2·00	1·90	1·88	1·97	1·96	1·94	2·22	2·42	2·19	2·83	3·04	2·90	2·68	2·14	2·52	2·40	1·
From Jan.1	21·28	19·78	17·58	19·25	17·75	19·39	19·75	12·68	16·73	16·26	17·32	16·54	16·18	15·58	16·93	17·69	17·62	18·80	18·60	19·71	19·27	18·17	20·04	19·48	17·

Day of Month	Chislehurst	Bickley	Becken-ham	Wimbledon (Sew. Wks.)	Wimbledon (Mt. Ararat)	Raynes Park	N. Malden (Gos. L.)	N. Malden (Sew. Wks.)	Surbiton	Kingston	Richmond	Kew	Brixton	West Norwood	Sydenham	Forest Hill	Deptford	Greenwich	Eltham	Wilming-ton
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	..	..	..	..	..	..	..	..	..	·01	·15	..	..	..	..	..	..	..	..
2	·09	·12	·05	·07	·08	·10	·14	·12	·09	·09	·12	·11	·06	·07	·07	·06	·05	·06	·10	·06
3	·12	·10	·11	·10	·12	·10	·01	..	·08	·11	·13	·12	·15	·08	·10	·05	·09	·13	·07	·02
4	·07	·08	·07	·06	·08	·08	·05	·06	·06	·09	·07	·07	·06	·07	·08	·02	·08	·08	·08	·10
5	·30	·23	·13	·31	·35	·40	·20	·23	·31	·59	·38	·24	·34	·30	·23	·34	·08	·08	·27	·29
6	..	..	..	·02	..	·02	..	..	·01	..	·11	·07	·12	·07	·05	·05	·05	·04	·05	..
7	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
8	·01	·02	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
9	·15	·17	·16	·07	·20	·21	·21	·19	·19	·19	·18	·19	·13	·16	·17	·17	·15	·16	·16	·10
10	·27	·13	·03	..	..	·01	..	..	·01	·03	·01	..	·01	·02	·16	·03	·03	·09	·03	·10
11	·08	·15	·13	·15	·23	·28	·13	·13	·29	·10	·07	·07	·18	·19	·15	·19	·03	·04	·01	·07
12	·04	·02	·02	·01	·02	·01	..	..	..	..	..	..	·02	·01	·02	·05	·01	·02	·07	·04
13	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·08	..	..	·01	..
14	·09	·10	·09	·14	·17	·17	·17	·16	·16	·18	·19	·16	·14	·11	·11	·15	·11	·13	·10	·04
15	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
16	..	..	..	..	..	..	..	..	..	..	·02	·01	..	..	..	..	..	..	..	..
17	·05	·04	·01	..	·05	·03	..	·02	..	..	·02	·01	..	·02	·01	..	..	..	·04	·05
18	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
19	·44	·69	·77	·32	·27	·34	·28	·25	·20	·25	·18	·26	·31	·41	·68	·22	·45	·47	·70	·42
20	·01	·01	..	·01	..	..	..	..	..	..	..	..	·12	·01	..	·10	..	·01	·03	·01
21	·20	·26	·26	·17	·10	·17	·09	·10	·11	·26	·36	·33	·20	·23	·24	·55	·22	·24	·24	·05
22	·09	·08	·08	·14	·13	·05	·09	·09	·06	·03	·09	·09	·11	·11	·11	·15	·05	·06	..	·15
23	·03	·03	·03	·04	·03	·04	·05	·03	·02	·04	·04	·02	·03	·03	·04	..	·03	·04	..	·03
24	·10	·11	·12	·23	·33	·33	·41	·31	·31	·41	·31	·25	·24	·20	·17	·15	·19	·16	·18	·12
25	..	..	·01	·02	·03	·02	..	..	..	..	·02	·01	·01	·01	·01	·01	..	..	·01	..
26	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
27	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
28	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
29	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
30	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	..	..	..
31	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	..
Total	2·14	2·34	2·08	1·86	2·19	2·36	1·83	1·69	1·90	2·37	2·31	2·17	2·23	2·11	2·40	2·37	1·62	1·81	2·15	1·65
From Jan.1	17·03	18·51	17·10	16·14	16·87	17·36	14·99	14·79	14·24	15·84	16·44	16·12	16·98	17·35	17·95	16·32	14·05	15·44	19·10	14·04

Note.—The observations are taken at 9 a.m., except at Brixton (8 a.m.), and Croydon (Dingwall Road) and Kew (10 a.m.).

NOTES.

(August, 1889.)

The month was cold and changeable, less showery over the S.E. of England than elsewhere, and very rainy in the W. and N. There was a decided improvement towards the end of the month, with high and rising temperature. At Kingston the storm on the 5th was particularly heavy, ·49 rain falling in twenty-two minutes.

Daily Rainfall. September, 1889.

Day of Month	ReigateHill	Caterham	Marden Park	Kenley	Purley (Reedham)	Purley (Tudor C.)	Ashtead	Esher	Sutton	Carshalton	Wallington	Bedding-ton	Waddon
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	..	..	..	..	..	..	..	..	..	..	..	..
2	·07	·12	·04	..	·05	·05	·05	·02	·09	·08	·06	·09	·09
3	..	..	..	..	..	..	..	..	..	..	..	..	·01
4	..	..	..	..	..	..	..	..	·02	·01	·01	·03	·02
5	..	..	·01	..	..	..	..	..	..	..	..	..	..
6	..	..	..	..	..	..	..	..	..	..	..	..	..
7	·02	·02	·01	·01	·03	·02	..	..	·03	·01	·01	·02	·02
8	..	..	..	..	..	..	..	..	..	..	..	..	..
9	..	..	..	..	..	..	..	..	..	..	..	..	..
10	..	..	..	..	..	..	..	..	..	..	..	..	..
11	..	..	..	..	..	..	..	..	..	..	..	..	..
12	..	..	..	..	..	..	..	..	..	..	..	..	..
13	..	..	..	..	..	..	..	..	..	..	..	..	..
14	..	..	..	..	..	..	..	..	..	..	..	..	..
15	..	..	..	..	..	..	..	..	..	..	..	..	..
16	..	..	..	..	..	..	..	..	..	..	..	..	..
17	..	..	..	..	..	..	..	..	..	..	..	..	..
18	..	..	..	..	..	..	..	..	..	..	..	..	..
19	·15	·16	·14	·14	·13	·10	·18	·11	·14	·13	·13	·13	·12
20	·01	..	·03	·03	·03	·05	·08	..	·01	·01	·02	·01	·02
21	·02	·07	·02	·03	·02	·03	·07	·02	·03	·02	·02	·01	..
22	..	..	..	..	..	..	..	·01	..	..	..	..	..
23	·17	·12	·11	·09	·08	·07	·18	·17	·10	·10	·09	·08	·06
24	·61	·57	·47	·58	·58	·60	·76	·52	·64	·56	·59	·58	·57
25	..	..	..	..	..	..	..	..	..	..	..	..	·05
26	..	..	..	..	..	..	..	..	..	..	..	..	..
27	..	·01	..	..	..	..	..	..	..	..	..	..	..
28	·01	..	·01	·01	·02	..	..	..	..	..	·01	..	..
29	·05	·03	·02	·03	·04	..	·12	·09	·05	·05	·04	·03	·03
30	·06	·05	·12	·05	·05	·08	·10	·08	·04	..	·03	·04	·05
Total	1·17	1·15	0·98	0·97	1·03	1·00	1·54	1·02	1·15	0·97	1·01	1·02	1·04
From Jan. 1	22·45	20·93	18·56	20·22	18·78	20·39	21·29	13·70	17·83	17·23	18·33	17·56	17·22

Day of Month	Croydon (Brim. Bn.)	Croydon (Ding. Rd.)	Croydon (Nant. H.)	Addis-combe	Addington (Park Fm.)	Addington (Hare's B.)	West Wickham	Hayes Common	Keston (Bradfield)	Keston (Heathfld.)	Keston (Kes. Tow.)	Orpington
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	..	..	..	..	..	..	..	..	..	..	..
2	·10	·11	·18	·19	·05	·06	·17	·21	·20	·27	·50	·53
3	..	..	·01	..	..	..	·01	·01	..	·01	·01	..
4	·02	..	..	..	·02	·01	..	..	..	..	..	·02
5	..	..	..	..	..	..	..	..	..	..	..	..
6	..	..	..	..	..	..	..	..	..	..	..	..
7	·02	·02	·03	·03	·02	..	·02	·03	·02	·03	·02	..
8	..	..	..	..	..	..	..	..	..	..	..	..
9	..	..	..	..	..	..	..	..	..	..	..	..
10	..	..	..	..	..	..	..	..	..	..	..	..
11	..	..	..	..	..	..	..	..	..	..	..	..
12	..	..	..	..	..	..	..	..	..	..	..	..
13	..	..	..	..	..	..	..	..	..	..	..	..
14	..	..	..	..	..	..	..	..	..	..	..	..
15	..	..	..	..	·01	·01	·01	..	·01	·01	..	..
16	..	..	..	..	..	..	..	..	..	..	..	..
17	..	..	..	..	..	..	..	..	..	..	..	..
18	..	..	..	..	..	..	..	..	..	..	..	..
19	·13	·13	·14	·14	·15	·14	·16	·15	·14	·17	·17	·15
20	·02	·02	·03	·03	..	·02	·01	·02	·02	·02	·01	·02
21	..	·01	·02	·02	·02	..	..	·01	·03	..	·02	..
22	..	..	..	..	..	..	..	..	..	·04	..	..
23	·07	·07	·06	·06	·05	·04	·07	·06	·06	·07	·06	·06
24	·56	·57	·54	·58	·51	·50	·49	·53	·45	·46	·49	·50
25	..	..	..	..	..	·01	..	..	..	·01	..	..
26	..	..	..	..	..	..	..	..	..	..	..	..
27	..	..	..	..	..	..	..	..	..	..	..	..
28	..	..	..	..	..	..	..	..	..	..	..	..
29	..	·03	·04	·03	..	·02	·10	·02	·02	·03	·02	..
30	·07	·03	·13	·12	·11	·09	..	·06	·07	·07	·08	..
Total	0·99	0·99	1·18	1·20	0·94	0·90	1·04	1·10	1·02	1·19	1·38	1·28
From Jan. 1	16·57	17·92	18·87	18·82	19·74	19·50	20·75	20·37	19·19	21·23	20·86	18·74

Day of Month	Chislehurst	Bickley	Beckenham	Wimbledon (Sew. Wks.)	Wimbledon (Mt. Ararat)	Raynes Park	N. Malden (Gos. L.)	N. Malden (Sew. Wks.)	Surbiton	Kingston	Richmond	Kew	Brixton	West Norwood	Sydenham	Forest Hill	Deptford	Greenwich	Eltham	Wilmington
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	..	..	..	..	..	..	..	..	..	..	..	..		..	..	..	..	·01	..
2	·94	·41	·28	·12	·08	·08	·03	·04	..	·02	·06	·04	·26		·19	·23	·27	·50	·66	3·90
3	·03	..	·01	..	·01	·01	..	..	..	..	..	..	·05		..	..	·05	·05	·05	·27
4	·01	..	..	..	..	..	..	..	..	..	..	..	..		..	..	..	..	..	..
5	..	..	..	..	..	..	..	..	..	..	..	·01	..		..	..	..	..	..	..
6	..	..	..	..	..	..	..	..	..	..	..	..	..		..	..	..	..	..	..
7	·03	·03	·02	·02	·04	·04	·02	·03	·01	·03	·15	·08	·01		·03	·02	..	..	·01	..
8	..	..	..	..	..	..	..	..	..	..	..	..	..		..	..	..	..	..	..
9	..	..	..	..	..	..	..	..	..	..	..	..	..		..	..	..	..	..	..
10	..	..	..	..	..	..	..	..	..	..	..	..	..		..	..	..	..	..	..
11	..	..	..	..	..	..	..	..	..	..	..	..	..		..	..	..	..	..	..
12	..	..	..	..	·01	..	..	..	..	..	..	·01	..		..	..	..	..	..	..
13	..	..	..	..	..	..	..	..	..	..	..	..	..		..	..	..	..	..	..
14	..	..	..	..	..	..	..	..	..	..	..	..	..		..	..	..	..	..	..
15	·02	..	..	..	..	..	..	..	..	..	..	..	..	See Note.	..	..	..	..	..	..
16	..	..	..	..	..	..	..	..	..	..	..	..	..		..	..	..	..	..	..
17	..	..	..	..	..	..	..	..	..	..	..	..	..		..	..	..	..	..	..
18	..	..	..	..	..	..	..	..	..	..	..	..	..		..	..	..	..	..	..
19	·15	·15	·15	·17	·20	·08	·15	·16	·13	·17	·17	·17	·14		·18	·17	·12	·14	·15	·13
20	·08	·14	·11	·04	·02	·03	..	..	..	·03	·04	·03	·11		·15	·06	·13	·10	·12	·06
21	·02	..	·01	·02	·02	·02	..	..	·03	·01	·02	·03	·01		·01	·02	·01	·02	·03	·01
22	..	..	..	..	..	..	..	..	..	..	..	..	..		..	..	..	..	·01	..
23	·10	·10	·08	·21	·21	·20	·14	·17	·21	·23	·20	·20	·21		·16	·15	·20	·19	·10	·09
24	·60	·59	·59	·67	·61	·60	·51	·57	·58	·73	·72	·79	·76		·74	·68	·64	·65	·66	·48
25	..	..	..	..	..	..	..	..	..	..	..	..	..		..	..	..	..	..	..
26	..	..	..	..	..	..	..	..	..	..	..	..	..		..	..	..	..	..	..
27	..	..	..	..	..	..	..	..	..	..	..	..	..		..	..	..	..	..	..
28	..	..	..	..	·02	·02	..	..	..	..	·01	..	..		..	..	..	..	..	..
29	..	..	·01	·03	·04	·05	·08	·08	·10	·13	·08	·08	..		·03	·02	·01	·01	·01	·03
30	·06	·08	·07	·03	·10	·08	·06	·07	·08	·09	·10	·13	·06		·08	·07	·04	·03	·05	·01
Total	2·04	1·50	1·33	1·31	1·36	1·21	0·99	1·12	1·14	1·44	1·55	1·57	1·61		1·57	1·42	1·47	1·69	1·86	4·98
From Jan. 1	19·07	20·01	18·43	17·45	18·23	18·57	15·98	15·91	15·38	17·28	17·99	17·69	18·59		19·52	17·74	15·52	17·13	20·96	19·02

Note.—The observations are taken at 9 a.m., except at Brixton (8 a.m.), and Croydon (Dingwall Road), and Kew (10 a.m.).

The gauge at West Norwood was, on September 11th, removed to another situation, and the return for the remainder of the year will not be printed in full. The total rain was 1·33 in.

NOTES.

(September, 1889.)

Very heavy rain fell on the 2nd in the Darenth Valley, the fall at Dartford being 4·00 in. Between the 9th and 13th, at Kew, the maximum thermometer in the shade averaged 76°. At Kew the first ground frost was experienced on the 17th, and bright sunshine was about the average.

Daily Rainfall. October, 1889.

Day of Month	Reigate Hill	Caterham	Marden Park	Kenley	Purley (Reedham)	Purley (Tudor C.)	Ashtead	Esher	Sutton	Carshalton	Wallington	Beddington	Waddon	Croydon (Brim. Bn.)	Croydon (Ding. Rd.)	Croydon (Nant. H.)	Addiscombe	Addington (Park Fm.)	Addington (Hare's B.)	West Wickham	Hayes Common	Keston (Bradfield)	Keston (Heathfld.)	Keston (Kes. Tow.)	Orpington
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·16	·05	·04	·07	·09	·08	·08	·03	·09	·19	·11	·09	·08	·10	·09		·05	·04	·04	·10	·11	·11	·13	·15	·39
2	·03	·03	..	·05	·03	·03	·05	·04	·02	·04	·02	·02	·02	·02	·02		·01	..	·01	..	·02	·02	·02	·01	·01
3	·38	·32	·34	·25	·25	·23	·42	·18	·28	·30	·32	·29	·27	·27	·27		·24	·37	·39	·33	·25	·23	·25	·23	·25
4	·37	·34	·24	·24	·23	·24	·36	·26	·23	·17	·20	·18	·18	·18	·17		·23	·22	·23	·25	·14	·15	·27	·28	·33
5	·34	·65	·45	·18	·16	·15	·19	·04	·12	·13	·13	·13	·15	·10	·12		·14	·17	·18	·22	·18	·17	·18	·27	·12
6	·37	·37	·31	·38	·23	·28	·28	·03	·24	·13	·30	·29	·26	·18	·26		·27	·32	·31	·35	·28	·24	·34	·32	·25
7	·01	·10	·01	·01	·01	·02	..	..	·02	·01	·02	·01	·02	·01	..		·01	·03	..	·01	·01	·01	·01	·01	..
8	·35	·41	·45	·44	·36	·37	·31	·21	·27	·25	·28	·25	·27	·22	·28		·29	·38	·41	·37	·36	·28	·29	·28	·24
9	·01	·02	·01	·01	..	·01	·06	..	·01	·01	..	..	..	..	..		..	..	..	..	..	..	·01	..	..
10	·02	·18	·17	·09	·11	·05	·20	·13	·08	·13	·05	·06	·07	·18	·13		·05	·05	·08	·04	·08	·09	·15	·13	·18
11	·06	·06	·05	·05	·09	·11	·07	·03	·15	..	·09	·07	·07	·07	·01		·04	·04	·03	·07	·06	·08	·04	·08	·15
12	..	·06	..	..	·01	·01	..	..	..	..	..	..	..	..	..		..	..	..	·01	..	·03	·04	·03	·03
13	..	..	·04	..	..	..	..	..	..	..	..	..	..	..	..		..	..	..	..	..	..	·01	..	..
14	..	..	..	..	..	·01	..	..	..	..	..	..	..	..	..		..	..	..	..	..	·02	·03	·03	·06
15	·09	·13	·08	·12	·11	·10	·15	·02	·07	·04	·04	·05	·05	·04	·05		·05	·03	·03	·05	·03	·03	·04	·03	02
16	·65	·47	·46	·50	·46	·47	·58	·37	·48	·47	·45	·43	·44	·43	·46	Record ceased.	·40	·47	·48	·58	·48	·47	·48	·49	70
17	..	·04	·02	..	·01	·01	..	·06	·05	·10	·11	·10	·09	·06	·11		·12	·04	·03	·01	·14	·06	·06	·08	·04
18	·27	·21	·18	·20	·17	·15	·21	·17	·15	·12	·12	·11	·08	·08	·12		·14	·19	·16	·25	·19	·23	·24	·23	·17
19	·83	1·22	1·22	1·19	1·05	1·05	·78	·48	·72	·80	·82	·73	·90	·85	·85		·79	·90	·99	1·03	·44	·71	·73	·69	·68
20	·38	·29	·16	·22	·20	·24	·42	·14	·24	·19	·26	·18	·13	·16	·13		·21	·43	·34	·45	·30	·33	·29	·29	·49
21	·04	·05	·08	·04	·06	·05	..	·16	·07	·01	·01	·02	·01	..	·01		·02	·04	·04	·07	·05	·08	·09	·08	·12
22	·02	·01	..	·02	·02	·02	..	..	..	·01	·02	·01	·01	..	·01		·01	·03	·03	·03	·01	·02	·04	·04	·03
23	·07	·04	·05	·05	·06	·05	·08	·03	·08	·05	·07	·04	·04	·06	·07		·06	·06	·06	·08	·14	·06	·06	·05	·07
24	·01	..	..	·01	·01	·01	..	..	..	·01	·01	..	..	..	..		..	..	·01	·01	..	·01	·01	..	..
25	·01	·04	·06	·06	·04	·04	..	..	·02	..	·01	·01	·01	·01	·01		·01	·04	·04	·06	·02	·05	·05	·03	·03
26	·36	·34	·37	·38	·40	·31	·58	·50	·38	·43	·41	·41	·39	·25	·43		·42	·43	·38	·47	·42	·40	·42	·43	·38
27	·26	·26	·29	·24	·24	·23	·35	·15	·22	·18	·22	·21	·18	·11	·18		·21	·23	·21	·20	·12	·24	·16	·15	·16
28	·03	..	·02	·02	·02	..	·06	·03	·02	·01	..	·01	·01	..	·01		·01	..	..	·01	·01	·02	·02	·03	·03
29	·01	·01	·01	·02	·03	·04	·10	·02	·02	..	..	..	..	..	·01		·01	..	·01	·01	·01	..	·01	..	..
30	·26	·24	·18	·25	·22	·24	·25	·19	·20	·17	·21	·21	·19	·16	·18		·19	·23	·19	·22	·21	·19	·23	·22	·20
31	·20	·16	·13	·19	·13	·15	·12	·04	·10	·12	·13	·11	·11	·05	·16		·11	..	·10	·10	·10	·09	·10	·09	·20
Total	5·59	6·10	5·42	5·28	4·80	4·75	5·70	3·31	4·33	4·07	4·41	4·02	4·03	3·59	4·14		4·09	4·74	4·78	5·38	4·16	4·42	4·80	4·75	5·33
From Jan. 1	28·04	27·03	23·98	25·50	23·58	25·14	26·99	17·01	22·21	21·30	22·74	21·58	21·25	20·16	22·06		22·91	24·24	24·28	26·13	24·53	23·16	26·03	25·61	24·07

Day of Month	Chislehurst	Bickley	Beckenham	Wimbledon (Sew. Wks.)	Wimbledon (Mt. Ararat)	Raynes Park	N. Malden (Gos. L.)	N. Malden (Sew. Wks.)	Surbiton	Kingston	Richmond	Kew	Brixton	West Norwood	Sydenham	Forest Hill	Deptford	Greenwich	Eltham	Wilmington
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·25	·04	·05	·12	·10	·09	..	·02	·07	·10	·07	·08	·09		·08	·03	·08	·07	·03	·11
2	·04	·02	·01	·04	·03	·04	·01	·03	·03	·05	·05	·05	·01		·01	·04	·01	·01	·03	..
3	·28	·28	·25	·27	·30	·31	·22	·29	·46	·35	·37	·39	·30		·31	·28	·23	·25	·33	·23
4	·21	·17	·22	·26	·29	·28	·37	·36	·31	·31	·26	·22	·24		·25	·24	·23	·22	·22	·22
5	·12	·10	·08	·16	·08	·08	·01	·02	·05	·16	·06	·12	·27		·07	·08	·33	·32	·08	·08
6	·22	·28	·22	..	·12	·13	·10	·11	·10	·11	·15	·08	·11		·21	·17	·12	·12	·23	·15
7	..	..	..	..	..	..	..	..	..	..	..	..	..		..	·02	..	..	·01	..
8	·21	·29	·25	·20	·23	·22	·21	·21	·22	·22	·16	·16	·20		·19	·15	·18	·18	·23	·16
9	..	..	..	·02	·01	·02	..	..	..	..	..	·01	·02		..	..	..	..	·01	..
10	·21	·22	·12	·06	·02	·05	·09	·08	·15	·16	·07	·14	·01		·09	·05	·11	·18	·18	·24
11	·09	·10	·04	·07	·13	·10	·11	·11	·01	·06	·12	·03	·04		·02	·10	·07	·09	·11	·08
12	..	..	..	..	..	..	..	..	..	·01	·02	·04	..		·01	..	..	..	·01	·01
13	..	..	..	..	..	..	..	..	..	..	..	·01	..		..	..	..	..	..	..
14	·02	..	..	..	..	..	..	..	..	..	..	..	..		..	..	..	..	..	..
15	·02	·02	·02	·02	..	·05	·06	·07	·05	·04	·07	·05	·02		..	·04	·01	·01	·01	·02
16	·62	·48	·47	·44	·71	·49	·55	·54	·55	·64	·56	·44	·41	See Note.	·45	·42	·40	·45	·52	·62
17	·06	·12	·04	..	..	..	..	..	·01	..	..	..	..		·01	..	..	..	·01	·01
18	·14	·13	·10	·08	·10	·08	·08	·08	·14	·09	·07	·04	·06		·09	·02	·07	·07	·12	·08
19	·58	·65	·79	·64	·75	·70	·67	·68	·59	·69	·73	·68	·71		·75	·27	·77	·76	·57	·53
20	·37	·22	·20	·21	·14	·19	·27	·25	·26	·31	·27	·31	·27		·14	·65	·13	·18	·39	·27
21	·07	·04	·02	·07	·07	·05	·06	·05	·02	·06	·08	·07	·16		·05	·08	·21	·26	·10	·20
22	·02	·02	·01	·07	·06	·05	..	·02	..	·01	..	..	·01		..	·02	..	·01	·02	·04
23	·03	·03	·03	·09	·06	·06	·06	·07	·06	·07	·11	·10	·05		·09	·06	·04	·04	·05	·02
24	..	..	..	..	·01	·01	..	..	..	..	..	·01	..		..	..	..	..	·01	..
25	·02	·02	..	..	..	..	..	..	..	..	..	..	..		·01	..	..	..	·01	·02
26	·30	·41	·33	·42	·45	·40	·31	·30	·40	·42	·45	·44	·41		·50	·45	·40	·44	·45	·44
27	·15	·17	·16	·16	·18	·17	·13	·13	·20	·18	·20	·19	·18		·18	·12	·11	·11	·16	·01
28	·03	·02	·02	·02	·06	·07	..	..	..	·02	·02	·03	·01		·01	·02	·01	·01	·04	·14
29	·01	..	..	·05	·02	·03	·02	·03	·04	·03	·03	·01	·02		·01	..	..	..	·01	..
30	·16	·17	·19	·16	·15	·15	·14	·12	·14	·16	·18	·20	·21		·21	·18	·17	·15	·14	·11
31	·06	·06	·06	·07	·06	·09	·05	·06	·05	·06	·09	·09	·05		·07	..	·05	·05	·05	·03
Total	4·29	4·06	3·68	3·70	4·13	3·91	3·52	3·63	3·91	4·31	4·19	3·99	3·86		3·81	3·47	3·73	3·98	4·13	3·82
From Jan. 1	23·36	24·07	22·11	21·15	22·36	22·48	19·50	19·54	19·29	21·59	22·18	21·68	22·45		23·33	21·21	19·25	21·11	25·09	22·84

Note. — The observations are taken at 9 a.m., except at Brixton (8 a.m.), and Croydon (Dingwall Road), and Kew (10 a.m.).

The gauge at West Norwood was, on September 11th, removed to another situation, and the return for the remainder of the year will not be printed in full. The total rain was 3·53 in.

NOTES.
(October, 1889.)

A very wet unsettled month, with frequent thunderstorms. Strong S.W. and N.W. gales on the 6th and 7th. Wind became easterly after the 18th. Bright sunshine at Kew is 3 per cent. below the average of the past twelve years.

Day of Month	ReigateHil.	Caterham	Marden Park	Kenley	Purley (Reedham.)	Purley (Tudor C.)	Ashtead	Esher	Sutton	Carshalton	Wallington	Bedding-ton	Waddon
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·05	·02	·05	·06	·06	·10	..	·03	·05	..	·05	·05	·05
2	·10	·15	·16	·12	·09	·06	·10	·04	·05	·07	·03	·05	·06
3	·41	·44	·46	·36	·29	·32	·21	·07	·17	·13	·22	·21	·19
4	..	..	..	..	..	..	..	..	..	..	..	..	..
5	..	..	..	..	..	..	..	..	..	..	..	..	..
6	·01	..	..	..	..	·01	..	..	..	..	..	..	..
7	·01	·02	·01	·01	..	·01	·05	..	·02	·01	·01	·01	·01
8	..	..	..	..	·02	..	..	..	..	..	..	..	..
9	..	..	·01	..	..	..	..	..	..	..	..	..	..
10	·01	..	·01	·01	..	·01	..	..	..	..	·01	..	·01
11	..	·01	..	·01	·02	·01	..	..	..	·01	..	·01	..
12	..	..	·01	..	..	..	..	..	·01	..	..	..	..
13	..	..	..	..	..	·01	..	..	..	..	·01	..	..
14	·02	..	..	..	·02	..	..	..	..	·01	..	..	..
15	..	..	..	..	..	..	..	..	..	..	..	..	..
16	..	..	..	·01	..	..	..	..	..	..	..	..	..
17	·03	·02	·01	..	..	·01	·08	..	·02	·01	·01	·01	..
18	·01	..	..	..	..	..	..	..	..	..	..	..	..
19	..	..	..	..	..	..	..	..	..	..	..	..	..
20	..	..	..	..	..	..	..	..	..	..	..	..	..
21	..	..	..	..	..	..	..	..	..	..	..	..	..
22	·01	..	..	·01	·01	..	·05	..	..	..	..	..	..
23	·05	·03	..	·05	·07	·05	·25	·10	·15	·15	·17	·15	·14
24	·55	·58	·32	·54	·42	·51	·34	·23	·28	·23	·36	·35	·28
25	·01	..	..	..	..	·01	..	..	..	..	..	..	..
26	..	..	·01	·01	·02	·03	..	..	·03	..	·03	·02	·04
27	..	..	..	·01	..	·01	..	..	..	..	..	..	..
28	..	..	..	..	..	..	..	..	..	..	..	..	..
29	..	..	..	..	..	..	..	..	..	·03	..	..	..
30	..	..	..	..	..	..	..	..	..	..	..	..	..
Total	1·27	1·27	1·05	1·20	1·02	1·15	1·08	0·47	0·78	0·65	0·90	0·86	0·78
From Jan. 1	29·31	28·30	25·03	26·70	24·60	26·29	28·07	17·48	22·99	21·95	23·64	22·44	22·03

Day of Month	Croydon (Brim. Bn.)	Croydon (Ding. Rd.)	Croydon (Nant. H.)	Addis-combe	Addington (Park Fm.)	Addington (Hare's B.)	West Wickham	Hayes Common	Keston (Bradfield)	Keston (Heathfld.)	Keston (Kes. Tow.)	Orpington
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·02	..		·05	·17	·04	·03	·05	·03	·04	·04	·12
2	·03	·12		·07	·04	·03	·12	·06	·12	·08	·02	..
3	·12	·15		·23	·34	·30	·31	·29	·25	·37	·48	·35
4	..	..		..	..	..	..	..	..	·01	..	..
5	..	..		..	..	..	..	..	..	..	..	..
6	..	..		..	..	..	..	..	..	..	..	..
7	..	·01		·02	·02	·01	·02	·01	·01	·02	·02	..
8	..	..		..	..	..	..	..	..	..	·01	..
9	..	..		..	..	..	..	..	..	..	..	..
10	..	..		·01	·01	·01	..	·01	·01	·01	·01	..
11	..	..		..	..	..	..	..	..	·01	·01	..
12	..	..		..	..	·01	..	·01	..	·01	..	..
13	..	·01		·01	..	·01	·02	..	..	·01	·02	..
14	..	..		..	..	..	..	..	..	..	..	..
15	..	..	Record ceased.	..	..	..	..	..	..	·01	..	..
16	..	..		..	..	..	..	..	..	..	..	..
17	..	·01		·01	..	..	·01	..	..	·01	..	..
18	..	..		..	..	..	..	..	..	..	..	..
19	..	..		..	..	..	..	..	..	..	..	..
20	..	..		..	..	..	..	..	..	..	..	..
21	..	..		..	..	..	..	..	..	..	..	..
22	..	..		..	..	..	..	..	..	·01	..	..
23	·16	·17		·11	·03	·02	·01	·03	·02	·01	..	..
24	·28	·30		·35	·43	·44	·48	·39	·32	·44	·46	·38
25	..	..		..	·06	·01	·01	·01	·02	..	..	..
26	·02	·02		·01	..	·05	..	·01	·01	·01	..	..
27	..	..		..	·03	·01	·02	·03	·04	·03	·04	·06
28	..	..		..	..	..	..	..	..	..	..	..
29	..	..		..	..	·01	..	..	..	·01	..	..
30	..	..		..	..	..	..	..	..	..	..	..
Total	0·63	0·79		0·87	1·13	0·95	1·03	0·90	0·83	1·09	1·11	0·91
From Jan. 1	20·79	22·85		23·78	25·37	25·23	27·16	25·43	23·99	27·12	26·72	24·98

Daily Rainfall. November, 1889.

Day of Month	Chislehurst	Bickley	Beckenham	Wimbledon (Sew. Wks.)	Wimbledon (Mt. Ararat)	Raynes Park	N. Malden (Gos. L.)	N. Malden (Sew. Wks.)	Surbiton	Kingston	Richmond	Kew	Brixton	West Norwood	Sydenham	Forest Hill	Deptford	Greenwich	Eltham	Wilmington
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·04	·05	·04	·04	·06	·05	·04	·05	·02	·03	..	..	·06		·03	·08	·03	·02	·04	..
2	·04	..	·05	·02	·04	·07	·01	..	·03	·08	·13	·11	·05		·11	·02	·05	·08	·04	·15
3	·24	·27	·19	·17	·16	·15	·19	·19	·17	·17	·12	·13	·20		·13	·21	·18	·17	·27	·13
4	..	..	..	..	..	..	..	..	..	..	..	·01	..		..	..	..	..	..	..
5	..	..	..	..	..	..	..	..	..	..	..	..	..		..	..	..	..	..	..
6	..	..	..	..	..	..	..	..	..	..	..	..	..		..	..	..	..	..	..
7	·01	·02	·01	..	·01	..	..	..	..	..	..	..	..		·01	..	..	..	·01	..
8	..	..	..	..	..	..	..	..	..	·01	..	·01	..		..	..	..	..	..	..
9	..	..	..	..	..	..	..	..	..	..	..	..	..		..	..	..	..	..	..
10	..	..	·01	..	..	..	..	..	..	..	..	..	..		..	..	..	..	·02	..
11	·01	..	..	..	..	..	..	..	..	..	..	..	..		·01	..	..	·01	..	·01
12	..	..	..	..	..	·01	..	..	..	..	..	·01	..		..	..	..	..	..	..
13	·01	..	..	..	..	·01	..	..	..	·01	..	·01	·01		·02	..	..	..	·01	..
14	..	..	..	..	..	·01	..	..	..	..	..	..	..		·01	..	..	..	..	..
15	..	..	·01	..	..	..	..	..	..	..	..	..	..	See Note.	..	..	..	..	..	..
16	..	..	..	..	..	·01	..	..	..	..	·02	..	·01		..	..	..	..	·01	·01
17	·01	..	..	..	..	..	..	..	..	..	..	·01	..		..	..	..	..	..	..
18	..	..	..	..	..	..	..	..	..	..	..	..	..		..	..	..	·01	..	..
19	..	..	..	..	..	..	..	..	..	..	..	..	..		..	..	..	..	..	..
20	..	..	..	..	..	..	..	..	..	..	..	..	..		..	..	..	..	..	..
21	..	..	..	..	..	..	..	..	..	..	..	..	..		..	..	..	..	..	..
22	..	..	..	..	·01	..	..	..	..	..	..	..	..		..	..	..	..	..	..
23	·04	·09	·12	·16	·16	·16	·14	·13	·14	·14	·12	·13	·14		·19	·19	·14	·14	·15	·21
24	·34	·30	·24	·19	·19	·21	·16	·15	·23	·23	·25	·26	·24		·21	·21	·37	·28	·39	·27
25	·02	..	..	..	..	·02	..	..	..	..	..	·01	·02		..	..	..	..	..	..
26	..	..	..	·03	..	·02	..	..	..	..	·02	·02	..		..	..	·01	·01	·02	·01
27	·05	..	..	·02	·03	·02	..	..	..	..	..	·01	·02		..	..	..	·01	·05	..
28	..	..	..	..	..	..	..	..	..	..	..	..	..		..	..	..	..	..	·10
29	..	..	..	..	..	..	..	..	..	..	..	..	..		..	..	..	..	..	·02
30	..	..	..	..	..	..	..	..	..	..	..	..	..		·01	..	..	..	..	..
Total	0·81	0·73	0·67	0·63	0·66	0·74	0·54	0·52	0·59	0·67	0·66	0·72	0·75		0·73	0·71	0·78	0·73	1·01	0·91
From Jan. 1	24·17	24·80	22·78	21·78	23·02	23·22	20·04	20·06	19·88	22·26	22·84	22·40	23·20		24·06	21·92	20·03	21·84	26·10	23·75

Note. — The observations are taken at 9 a.m., except at Brixton (8 a.m.), and Croydon (Dingwall Road) and Kew (10 a.m.).

The gauge at West Norwood was, on September 11th, removed to another situation, and the return for the remainder of the year will not be printed in full. The total rain was 0·65 in.

NOTES.

(November, 1889.)

Although the distribution of pressure was mainly anti-cyclonic, the weather was unusually mild, the air damp, and the rainfall small. Fog was prevalent, but not of an irritating character. Towards the end of the month frost set in over the greater part of England.

Daily Rainfall. **December, 1889.**

Day of Month	Reigate Hill	Caterham	Marden Park	Kenley	Purley (Reedham)	Purley (Tudor C.)	Ashtead	Esher	Sutton	Carshalton	Wallington	Bedding-ton
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	..	..	..	..	..	..	..	..	..	..	..
2	..	..	..	..	..	..	..	..	..	..	..	..
3	..	..	..	..	..	..	..	..	..	..	..	..
4	..	..	..	..	..	..	..	..	..	·02	·01	..
5	·06	..	..	·06	·07	·06	..	·03	·05	·02	·04	·04
6	·18	·24	..	·09	·08	·05	·09	·08	·02	·10	·07	·07
7	·12	·08	·27	·11	·10	·04	·18	·07	·16	·06	·13	·11
8	·48	·26	·25	·02	·08	·20	·10	·05	·10	·09	·10	·09
9	·06	·02	..	·02	·01	·03	..	..	·01	..	·01	·01
10	..	..	·04	·03	·02	·04	..	..	·03	·02	·03	·02
11	..	..	..	..	..	..	..	..	..	..	..	..
12	·18	·19	·13	·12	·12	·13	·16	·03	·08	·02	·09	·08
13	·16	·13	·14	·18	·15	·15	·08	..	·06	·08	·06	·06
14	..	·01	..	·01	·01	..	..	·03	..	·01	..	..
15	·02	·04	·02	·02	·01	·02	..	..	·01	·01	·01	·01
16	·05	·03	·03	·04	·02	·03	·05	·02	·01	·01	·01	·01
17	·02	·02	·01	·01	..	..	..	..	..	..	..	..
18	·13	·12	·07	·05	..	·04	·04	..	..	..	·01	·01
19	·04	..	·02	·03	·05	·05	..	..	..	·01	·01	·01
20	·15	·14	·07	·17	·14	·13	·15	·05	·16	·12	·16	·13
21	·37	·47	·38	·34	·24	·25	·30	·21	·24	·23	·23	·23
22	·29	·32	·28	·30	·27	·30	·34	·29	·27	·23	·27	·27
23	·18	·18	·14	·15	·13	·15	·14	·05	·08	·08	·10	·09
24	·12	·15	·13	·14	·09	·11	·10	·03	·06	·03	·07	·07
25	·01	..	·02	..	·01	·01	..	..	·01	·01	·02	·01
26	..	..	..	·01	..	·01	..	..	..	..	..	..
27	..	..	..	..	..	..	..	..	..	..	..	..
28	..	..	..	..	..	..	..	..	..	..	..	..
29	..	..	·02	·01	·03	..	..	..	·01	·02	·02	..
30	..	..	..	..	·01	·02	..	..	..	·01	..	..
31	..	..	..	..	..	..	..	..	..	..	·01	·01
Total	2·62	2·40	2·02	1·91	1·64	1·82	1·73	0·94	1·36	1·18	1·46	1·33
From Jan. 1	31·93	30·70	27·05	28·61	26·24	28·11	29·80	18·42	24·35	23·13	25·10	23·77

Day of Month	Waddon	Croydon (Brim. Bn.)	Croydon (Ding. Rd.)	Croydon (Nant. H.)	Addis-combe	Addington (Park Fm.)	Addington (Hare's B.)	West Wickham	Hayes Common	Keston (Bradfield)	Keston (Heathfld.)	Keston (Kes. Tow.)	Orpington
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	..	..	Record ceased.	..	..	·01	..	..	..	..	..	..
2	..	..	..		..	..	..	..	..	..	..	..	..
3	..	..	..		..	..	..	..	..	..	·01	..	..
4	..	..	..		..	..	..	..	·01	..	..	..	..
5	·04	..	·03		·03	·03	·05	·06	·03	·07	·07	·07	·05
6	·05	..	·11		·09	·04	·07	·06	·07	·06	·07	·06	..
7	·10	·21	·06		·10	·14	·10	·09	·10	·12	·12	·13	·18
8	·07	·08	·09		·10	·10	·08	·11	·10	·08	·11	·10	·10
9	..	..	..		·01	·02	·01	·04	·01	..	·02	·01	..
10	·03	..	·02		·02	·03	·02	·05	·02	·03	·03	·02	·02
11	..	..	..		·01	..	..	..	..	..	..	..	..
12	·07	·06	·09		·07	·07	·06	·06	·09	·09	·13	·11	·12
13	·06	·06	·04		·08	·18	·17	·18	·16	·14	·16	·16	..
14	..	..	·01		..	·01	..	·01	·01	..	·01	·01	..
15	·01	..	·01		·01	·02	·01	..	·01	·02	·02	·02	..
16	·01	·02	·01		·02	·02	·02	·03	·02	·03	·03	·02	·13
17	..	..	..		..	..	..	·01	·02	..	·01	..	..
18	..	..	·01		·02	·03	·03	·05	..	·03	·05	·03	·02
19	·02	..	·01		·02	·01	·02	·02	·03	·02	·04	·03	·02
20	·13	·09	·13		·01	·14	·13	·15	·15	·10	·12	·11	·10
21	·23	·19	·26		·25	·25	·22	·32	·24	·20	·26	·27	·25
22	·26	·27	·31		·27	·28	·27	·32	·28	·27	·28	·30	·26
23	·08	·06	·12		·09	·05	·08	·06	·09	·10	·13	·11	·08
24	·06	·04	·03		·06	·15	·11	·16	·08	·09	·10	·10	·08
25	·01	..	·01		·01	..	..	·01	·01	..	·02	·01	..
26	..	..	..		..	..	..	..	..	..	..	..	..
27	..	..	..		..	..	..	..	..	..	..	..	..
28	..	..	..		..	..	..	..	..	..	..	..	..
29	..	..	·01		·03	·01	·03	·05	·02	·04	·04	·04	..
30	..	..	..		..	..	..	..	..	..	..	..	..
31	..	..	..		..	..	..	..	·01	..	·01	..	..
Total	1·23	1·08	1·36		1·40	1·58	1·49	1·84	1·56	1·49	1·84	1·71	1·41
From Jan. 1	23·26	21·87	24·21		25·18	26·95	26·72	29·00	26·99	25·48	28·96	28·43	26·39

Daily Rainfall. **December, 1889.**

Day of Month	Chislehurst	Bickley	Beckenham	Wimbledon (Sew. Wks.)	Wimbledon (Mt. Ararat)	Raynes Park	N. Malden (Gos. L.)	N. Malden (Sew. Wks.)	Surbiton	Kingston	Richmond	Kew	Brixton	West Norwood	Sydenham	Forest Hill	Deptford	Greenwich	Eltham	Wilmington
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	··	··	··	··	··	··	Record ceased.	··	··	··	··	·01	··	See Note.	··	··	··	··	··	··
2	··	··	··	··	··	··		··	··	··	··	··	··		··	··	··	··	··	··
3	··	··	··	··	··	··		··	··	··	··	··	··		··	··	··	··	··	··
4	·02	··	··	··	··	··		··	··	··	··	··	··		··	·05	··	··	··	··
5	··	·09	·04	·04	·03	·04		·04	·02	·04	·04	·02	·05		·07	··	·03	·02	·03	·02
6	··	··	·06	·09	··	·09		·10	·09	·15	·12	·15	·06		·08	·04	·08	·07	·07	·04
7	·15	·21	·11	·13	·22	·13		·17	·09	·09	·10	·07	·22		·01	·08	·12	·14	·13	·23
8	·09	·09	·11	·12	·11	·11		··	·06	·09	·11	·09	·16		·25	·06	·13	·12	·13	·02
9	·01	··	·01	·03	·01	·02		·02	·02	·01	·02	·01	·01		·01	·05	··	··	·01	··
10	·02	··	·02	·04	·05	·04		·03	·02	·02	·03	·01	·05		·05	·17	·02	·02	··	··
11	·06	··	··	··	··	·03		··	··	··	··	·01	··		··	··	··	··	··	··
12	·07	·08	·04	·03	··	·05		·06	·07	·08	·03	·04	·01		··	··	·02	·02	·07	·07
13	·14	·12	·08	·10	·14	·10		·08	·05	·05	·05	·04	·15		·01	·11	··	·07	·10	·13
14	·01	··	·01	··	··	··		··	··	··	··	··	··		·08	··	··	··	··	··
15	·02	·02	·01	·01	·01	·01		··	·01	·01	·02	·02	·02		·01	··	··	·01	·02	·01
16	·03	·03	·02	·03	·03	·03		·02	··	·02	·04	·03	·01		·03	··	·02	·02	·03	·01
17	··	··	··	··	··	··		··	··	··	··	··	·02		··	·02	··	··	··	··
18	·02	·02	·03	·02	·02	·03		·02	·01	·02	·03	·01	·04		·03	·05	·03	·04	·03	··
19	·02	·02	·01	·01	··	·01		··	··	··	··	··	··		··	··	··	··	·01	·02
20	·10	·11	·10	·07	··	·09		·07	·07	·08	·06	·06	·08		·11	·02	·09	·10	·10	·08
21	·28	·29	·26	·23	·34	·25		·20	·23	·25	·29	·28	·25		·26	·23	·27	·31	·17	·23
22	·32	·31	·29	·33	·35	·38		·31	·33	·32	·22	·21	·25		·34	·38	·35	·35	·32	·27
23	·05	·06	·05	·06	·06	·08		·06	·07	·07	·07	·07	·02		·06	·06	·04	·05	·05	·03
24	·07	·06	·05	·05	·05	·06		·02	·05	·06	·07	·05	·09		·06	·05	·05	·06	·05	··
25	·01	··	·01	··	·01	·02		··	··	·01	··	·01	··		··	··	··	··	··	··
26	··	··	··	··	··	··		··	··	··	··	··	··		··	··	··	··	··	·04
27	··	··	··	··	··	··		··	··	··	··	··	··		··	··	·04	··	··	··
28	··	··	··	··	··	··		··	··	··	··	··	··		··	··	··	··	··	··
29	·04	··	·03	·03	··	·02		··	··	··	·04	·02	·01		··	··	··	·04	·04	·03
30	··	··	··	··	··	··		··	··	·02	··	··	··		··	··	··	··	··	··
31	··	··	··	··	·03	··		··	··	··	··	··	··		··	··	··	··	··	··
Total	1·53	1·51	1·34	1·42	1·46	1·59		1·20	1·19	1·39	1·34	1·21	1·50		1·46	1·37	1·29	1·44	1·36	1·23
From Jan. 1	25·70	26·31	24·12	23·20	24·48	24·81		21·26	21·07	23·65	24·18	23·61	24·70		25·52	23·29	21·32	23·28	27·46	24·98

Note. — The observations are taken at 9 a.m., except at Brixton (8 a.m.), and Croydon (Dingwall Road) and Kew (10 a.m.).

The gauge at West Norwood was, on September 11th, removed to another situation, and the return for the remainder of the year will not be printed in full. The total rain was 1·35 in.

NOTES.

(December, 1889.)

The first and last weeks of the month were cold and frosty, with slight showers of snow on the 7th and 29th. Fog was rather prevalent, but not, as a rule, of an irritating character. The rainfall is below the average at most, if not all, stations.

APPENDIX III.

MONTHLY RECORDS.

Station.	Jan.	Feb.	Mar.	Apr.	May	Jun.	July	Aug.	Sep.	Oct.	Nov.	Dec.	Year.
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
*Dorking ..	1·42	3·05	2·94	2·28	4·08	1·04	1·42	2·39	1·17	5·68	1·33	2·19	28·99
*Knockholt	1·39	3·07	2·70	3·28	1·80	1·52	3·06	2·71	1·58	4·85†	0·95	2·40	29·31
**Esher ..	0·92	1·99	1·63	2·09	2·64	0·72	2·25	2·00	1·30	3·72	0·74	1·43	21·43
**Sutton ..	1·08	2·27	1·60	1·97	3·16	0·87	2·65	2·00	1·09	4·09	0·75	1·27	22·80
**Woolwich	0·82	3·81	1·60	2·15	4·05	2·94	2·64	2·66	0·96	4·01	1·22††	1·00†††	27·86

† Taken November 4th. †† Taken December 11th. ††† Estimated.

APPENDIX IV.

Falls of 1·0 in. and upwards.

March 7th.

Reigate Hill, 1·12 in.; Marden Park, 1·07 in.; Dorking, 1·06 in.; Kenley, 1·04 in.; Caterham, 1·00 in.

May 25th.

Chislehurst, 1·13 in.

May 26th.

Dorking, 1·75 in.; Ashtead, 1·67 in.; Esher (Sewerage Works), 1·52 in.; Kew, 1·51 in.; Kingston, 1·48 in.; Surbiton, 1·44 in.; Richmond, 1·36 in.; Wimbledon (Sewerage Works), 1·31 in.; New Malden (both Stations), 1·30 in.; Sutton (Mulgrave Road), 1·24 in.; Carshalton, 1·22 in.; Raynes Park, 1·14 in.; Wimbledon (Mount Ararat), 1·09 in.; Beddington, 1·03 in.

June 9th.

Eltham, 1·08 in.; Bickley, 1·05 in.; Sydenham, 1·02 in.

July 21st.

Eltham, 1·13 in.; Sydenham, 1·09 in.; Beckenham, 1·01 in.

September 2nd.

Wilmington, 3·90 in.; Farningham Hill, 2·46 in.

October 19th.

Caterham and Marden Park, 1·22 in.; Kenley, 1·19 in.; Purley (both Stations), 1·05 in.; West Wickham, 1·03 in.

CONTENTS.

PROCEEDINGS.

TRANSACTIONS.

Croydon Microscopical and Natural History Club.

OFFICERS FOR 1890.

President.—EDWARD LOVETT.

Vice-Presidents.—JOHN BERNEY, F.R.M.S.; ALFRED CARPENTER, M.D., J.P., &c.; PHILIP CROWLEY, F.L.S., F.Z.S., &c.; HENRY S. EATON, M.A., F.R.Met.Soc.; HENRY T. MENNELL, F.L.S.; HENRY G. THOMPSON, M.D.

Treasurer.—KENNETH McKEAN, F.L.S.

Committee.—Dr. A. B. CARPENTER, F.R.M.S., &c.; THOS. CUSHING, F.R.A.S.; JAMES EPPS, jun., F.L.S.; C. H. GOODMAN; J. W. HELPS; W. MURTON HOLMES; CHAS. F. OAKLEY; W. LOW SARJEANT; ERNEST STRAKER.

Hon. Secretary.—FRANCIS C. BAYARD, LL.M., F.R. Met. Soc., Manor Road, Wallington, Surrey, to whom all communications may be addressed.

PROCEEDINGS & TRANSACTIONS

OF THE

CROYDON

MICROSCOPICAL & NATURAL HISTORY

CLUB.

FEBRUARY 12, 1890, TO JANUARY 21, 1891.

CROYDON:

PRINTED FOR THE CLUB, BY WEST, NEWMAN & CO., HATTON GARDEN, LONDON.

1891.

PROCEEDINGS

OF

THE CROYDON MICROSCOPICAL AND NATURAL HISTORY CLUB.

1890—91.

Twenty-first Annual Meeting.

Held at the Public Hall, Croydon, Wednesday, January, 21*st*, 1891.

EDWARD LOVETT, President, in the chair.

The Balance-sheet of the accounts for the year 1890 was taken as read (page cxlxx) and passed, and a vote of thanks accorded to the Auditors.

It was proposed by Mr. McKean, and seconded by the President, that Mr. Sturge be elected Treasurer in the place of Mr. McKean, resigned; which was carried unanimously, and a cordial vote of thanks was passed to Mr. McKean for his services as Treasurer to the Club.

No other nominations having been received, Mr. K. McKean, and Mr. H. D. Gower, were elected to serve on the Committee in the place of Mr. T. Cushing, and Mr. J. W. Helps, to whom a vote of thanks was passed on their retirement.

The following is the list of officers for the year 1891:—

President.—EDWARD LOVETT.

Vice-Presidents.—JOHN BERNEY, F.R.M.S.; ALFRED CARPENTER, M.D., J.P., &c.; PHILIP CROWLEY, F.L.S., F.Z.S., &c.; HENRY S. EATON, M.A., F.R.Met.Soc.; HENRY T. MENNELL, F.L.S.; HENRY G. THOMPSON, M.D.

Treasurer.—EDWARD B. STURGE.

Hon. Secretary.—FRANCIS C. BAYARD, LL.M., F.R.Met.Soc.

Committee.—DR. A. B. CARPENTER, F.R.M.S., &c.; JAMES EPPS, JUN., F.L.S.; C. H. GOODMAN; H. D. GOWER;

W. Murton Holmes; Kenneth McKean, F.L.S.; C. F. Oakley; W. Low Sarjeant; Ernest Straker.

The President then delivered his Address, at the conclusion of which a hearty vote of thanks was accorded to him for his Address, and also for his services during the past year.

A vote of thanks to the Local Press for its services in connection with the meetings of the Club terminated the proceedings.

The President's Address.

Gentlemen,—I do not think it is possible for me to devise a better system than that which has been followed by my predecessors in devoting the Annual Address to a review of the history of the Club for the preceding year; and it is with great pleasure that I am able to report that the Croydon Microscopical and Natural History Club is as flourishing and as good for work in the twenty-first year of its existence as at any previous time.

During the past year 44 new members have been enrolled, but we have lost 35: 5 of these have died, and many of the remainder have left the neighbourhood, so that in this respect we have lost more than usual. Of those who have died we must especially allude with regret to Dr. E. Berney, Mr. Chas. Grundy, and Mr. W. Mosse Robinson, names well known by us all in this town of Croydon.

Our present list of members therefore is 285, to which add 7 honorary members, and two associates, bringing up the total to 294—a net increase of 9 members for the year. As there are 9 other names for ballot this evening, the steady increase in our growth as a Club is well maintained.

In reference to our financial position, I think a few retrospective and prospective remarks are necessary. In the Balance-sheet before you, it will be seen that we commenced the year with a balance of £9 5s. 8d. and finish with one of £20 9s. 3d. This, however, does not include the cost of printing our Transactions for 1889, and several other bills which had not been received when the Accounts were closed. These together may be estimated at about £40, making the balance on the debtor side of the Accounts; against this we have of course the usual floating amount of unpaid subscriptions. However, it is evident that our expenditure is advancing in a somewhat serious manner, as the following figures show:—

In 1887	our receipts were	£138;	expenditure	£128,	+13
1888	,,	£149	,,	£151,	— 2
1889	,,	£146	,,	£170,	—24
1890	,,	£157	,,	£146, due £40,	—29

It therefore becomes us to watch our future with care, and

endeavour to keep well within our income. Our Annual Soirée is still a severe tax on our resources, but its success and the reputation it enjoys fully justify its cost; and I believe we are in an unique position in giving such an entertainment on so small an annual subscription.

You have seen that, in spite of additions to our membership, resignations prevent anything like a large increase of revenue: may I therefore remind all our members that they can materially assist the well-being of the Club by obtaining fresh members, and thereby increasing our annual income. A membership of 400 would by no means increase our expenses *pro rata*, and would give us a fair annual surplus.

With such a varied series of work as we do, and with such a small subscription, carrying as it does so many advantages, we ought in so populous a district to obtain a more regular accession of new members than we do even now, and I again urge our present members individually to forward our interests by introducing as many of their friends as possible.

As regards our Special Fund, there is nothing worthy of remark except that it carries a balance of £27 2s. 10d., which I believe may be applied to the purchase of apparatus and appliances for the use of members.

Our Sub-Sections are doing very good work, and the reports which have been sent in by the various Secretaries show that the past year has been one of general activity and prosperity. These reports are as follows, *viz*:—

Report of the Botanical Sub-Committee, January, 1890.

The Botanical Sub-Committee report that the whole of the specimens in the Herbarium of the Club have been securely mounted and labelled, and are arranged in the cabinet in the Committee Room, where they can be referred to by members. It is hoped that further considerable contributions to the collection will be received shortly, as the result of the work of our local botanists during the past season. Assistance in this direction is earnestly invited. The Sub-Committee have sustained a serious loss by the removal of their valued colleague, Mr. Wm. Fred. Miller from Croydon. His services to the Club, as the recorder of the dates of the flowering of plants in the county, extending over a long series of years, the results of which have been published in the Transactions of the Club, have been of great value, and his place will be difficult to supply. It would be an appropriate recognition of his services to the Club were he elected an Honorary Member. The excursion under the auspices of the Botanical Committee was unfortunately, owing to the weather, a failure. Mr. Straker, who kindly undertook to conduct it, reports that only two members, neither of them botanists, accompanied him, and that the programme laid down had to be curtailed and altered. Mr. Beeby, in a letter to the Secretary of the Committee, says:—

"The only striking addition to our Surrey list is *Ulex gallii*, a plant

which is incorrectly reported about as often as *Scleranthus perennis*, but which I found for the first time on a heath near Horsell. Besides this, a good deal of work has been done in some of the critical genera, such as *Salix*, *Epilobium*, &c., the latter entirely by the Rev. E. S. Marshall, and the former partially by him."

In 'Science Gossip' there recently appeared a notice that *Dianthus cæsius*, the Cheddar pink, had been found near Guildford on the limestone (presumably chalk is meant); as this plant is confined to the limestone cliffs of the Mendips, its discovery in our county would, if confirmed, be of great interest, but as it is a plant not unfrequently cultivated, it would be necessary to be sure that it had not been intentionally or accidentally introduced.

In the 'Daily News' recently, there appeared a notice not strictly appertaining to this Sub-Committee, which Mr. Berney and the Zoological Sub-Committee will, we trust, excuse us for referring to, so closely is it connected with our province. We refer to a statement that the dreaded *Phylloxera* had appeared in one of the vineries at Kew Gardens during last summer, apparently introduced with some young vines from Hungary:—

"The most unwelcome of all visitors to Kew Gardens last summer, was found in one of the vineries in the form of an undoubted specimen of the dreaded *Phylloxera*. It appears from the statement of Mr. Morris that it was first observed in a corner of a house containing young vine plants from Hungary; but both root and leaf galls were subsequently found on another plant at the other end. The natural impulse of the scientific mind was to institute at once a careful series of investigations and experiments; but, looking to the subtle and amazing power of propagation which characterises these pests, it was determined instantly to destroy everything growing in the house. This was done with scrupulous care—first by igniting sulphur, after syringing the whole of the interior with water, and then by burning every part of each plant so as to calcine the soil thoroughly. Besides these precautions every bit of rotten or defective woodwork was removed and burnt, and, lastly, the entire remaining woodwork was scraped and repainted."

At the recent Soirée of the Club a very interesting series of dried plants were exhibited by Mr. Salmon, of Reigate. These were especially noteworthy for the excellence of the specimens, the careful drying, and the skilful and artistic mounting. They were an excellent example of what can be done in this direction.—Henry T. Mennell, *Hon. Sec.*

Report of the Geological Sub-Committee, January, 1890.

There have been very few fresh excavations or sections made in our district during the past year except at Shirley, a valuable paper on which was read before the Geologists' Association, 6th June last, by our member Mr. H. M. Klaassen, F.G.S., who has kindly allowed me to quote some of his observations here.

"*The Pebbly and Sandy Beds overlying the Woolwich and Reading Series on and near Addington Hills, Surrey.*

"Early in the spring of the present year (1890), the upper part of the village of Shirley was connected with the main drainage of Croydon,

and excavations for a sewer were made in a nearly direct line from the windmill in Shirley road, past the Sandrock Hotel, to 250 feet beyond the Infant School, near the top of the Addington Hills. These excavations have a special interest. They give a continuous section from the Blackheath to the underlying beds, and throw some light upon the long disputed question as to what formation the pebbly and sandy beds, which overlie the Woolwich and Reading series, belong to. Some geologists have classed them with the Oldhaven, others have grouped them with the Woolwich and Reading, beds. For years a controversy upon this question has been carried on by Messrs. J. Starkie Gardner, G. F. Harris, Prof. Prestwich, and W. Whitaker. The arguments for and against the different views are summarised in Whitaker's 'Geology of London,' vol. i., pp. 90—102 (1889). The section, 1636 feet long, begins on the Addington Hills at a height of 418 feet above Ordnance datum, and ends in Shirley Road, Croydon, at 320 feet.

"The excavations show:—

	FT.	IN.
On Addington Hills, 418 *ft. above O. D.*		
Flint pebbles in light coloured sand	12	0
At the Sandrock Hotel, 360 *ft. above O. D.*		
Dark brown sand	1	6
Yellow sand, and grey sand with impure pipe clay	17	6
At the Drinking Fountain, 347 *ft. above O. D.*		
Flint pebbles	0	6
Yellow sand	0	9
Grey sand with impure pipe clay	9	0
Mottled clay, Reading bed	12	0
Pebble rock with mottled clay and green sand	4	0
Green sand, Woolwich and Reading bottom bed	3	0
At 337 *ft. above O. D.*		
Woolwich blue and black clay	11	0
Reading mottled clay	9	0
Near the Windmill, Shirley Road, 320 *ft. above O. D.*		
Pebbles, yellow and grey sand	6	0
Woolwich blue clay	2	0

"The sewer excavations afforded little scope for detailed examination, but near the line of excavations there are pits at different levels, where the pebbly and sandy beds can be conveniently examined. The highest bed of the Addington Hills is the Blackheath pebble bed, consisting of small and large flint pebbles in a fine sandy base; the sand is incoherent and without fossils, its colour reddish yellow, and in long exposed sections yellowish grey. The exact thickness of the bed could not be ascertained; in our section it begins at 380 ft. above Ordnance datum, and is continuous to 481 ft., the highest point of the hill, where bleached pebbles lie exposed on the surface," *et. seq.*

The foregoing table, however, serves for our present purpose, but I hope we may be able to quote further from this interesting paper. I understand that some of the Shirley villagers upon seeing the lignite, which was discovered in the excavations, thought that coal had been found, and took it home to burn; but it was of little use, and was moreover highly charged with pyrites.

The geological excursion of the year took place on Monday, Augu 4th, and was very well attended, twenty-seven members of the C]

being present. Most of this number drove from Croydon to Caterham where the remainder joined them. The walk then commenced by passing over the outcrop of the chalk, just visible at a rise of the road outside Caterham, to the firestone pits of the upper green sand formation. These pits were explored by the kind permission of Mr. Brotherton, and under the direction of his manager. The workings, which penetrate the base of a hill till they reach a point 300 ft. below the summit, are very tortuous and intricate, and have been worked for a very long period. The firestone, when cut from its natural bed, is workable by the curious primitive tools still in use, but upon exposure to heat or air it rapidly hardens, thus fitting it for furnace floors and other similar purposes. This subterranean ramble was much enjoyed, and the workings were shown up by magnesium light by one of the party. Several good photographs of geological interest were also taken. After traversing the intervening strata, no good sections of which were uncovered or exposed, the party visited the silver sand pits in the lower green sand formation near Godstone. Beyond weathering action and the veining of the sand rock, there was not much of special interest, but some further photographs were obtained.

Tilburstow Hill was next visited, where a large pit of a ferruginous sandstone occurs; this and some large masses of chert from the immediate neighbourhood were carefully examined: and a survey of the surrounding country was obtained from the highest point of the hill, the chalk and green sand escarpments, and the large expanse of the formerly forest-clad Weald being well made out. After a beautiful walk to Oxted, the party returned to Croydon.

Some additions have been made to the series of photographs illustrating geological phenomena, which is being formed by the Club, and it is hoped that these will be constantly added to, in order that we may in time possess a large collection of such photographs, which cannot fail to be of interest and use to those who may be studying the physical aspect of geology. In the future when we obtain larger premises such a collection would form a suitable adornment for the walls of our Club-rooms. This Sub-Committee is always desirous of giving any assistance or information in its power to members who may wish to become better acquainted with the geology of the district.—Ed. Lovett, *Hon. Sec.*

Report of the Meteorological Sub-Committee, January, 1890.

The Meteorological Sub-Committee has continued its work under the supervision of its Honorary Secretary, Mr. Bayard. The daily rainfall of 48 stations in the Club district has been tabulated every month, examined and corrected, and the results printed and issued to the observers and all members of the Club interested in the question, either before, or within a very few days after, the end of the month succeeding that to which the statistics refer.

The Sub-Committee also desire to mention that Mr. Bayard has taken weekly temperature observations in the River Wandle, in Surrey. They were taken between 3 and 3.30 p.m. on Sunday afternoons, and extended from October, 1888 to February, 1890. This record was presented by the Club's delegate, Mr. Cushing, to Dr. Mill, the Honorary Secretary of "The Committee on Temperature variation in Lakes, Rivers, and Estuaries," at the Leeds Meeting, 1890, of the British

Association, and the Sub-Committee have included it in their Report, which will be found in the 'Transactions.'

At the beginning of the year the Committee made a grant to the Meteorological Sub-Committee of £25, for the expenses connected with the rainfall returns.

The excursion of the 4th October, 1890, was under the direction of this Sub-Committee. On the invitation of G. M. Whipple, Esq., Superintendent of Kew Observatory, eleven members of the Club, including the Hon. Sec., interested in meteorology and photography, paid a visit to the observatory. They were all most courteously received by Mr. Whipple and the staff of the Observatory. Mr. Whipple first gave the members a short history of the Observatory, and then the party were divided, and part went over the Observatory with Mr. Whipple, and the remainder with the Chief Assistant. All the instruments, photographic and otherwise, were shown, as was also the library, which contained some most interesting works, scientific and otherwise. In addition to the attractions of the Observatory, as there was an entertainment in the Old Deer Park where the Observatory is situated, the party enjoyed the privilege of seeing the descent of Prof Baldwin in a parachute, from a balloon.—F. C. BAYARD, *Hon. Sec.*

REPORT OF THE MICROSCOPICAL SUB-COMMITTEE, JANUARY, 1890.

The Microscopical Sub-Committee have taken in hand the arrangement of the slides of microscopic objects in the Club Cabinet. A strictly scientific classification was found impracticable, but in order to facilitate the introduction of fresh slides, the collection was divided into sections corresponding to the letters of the alphabet, so that members applying for slides should give the letter as well as the number of the slides they require. A list of the slides was for the first time printed in the last issue of the 'Transactions.'

The Club is very much indebted to Mr. Harry Lee, for a very valuable and interesting collection of slides of sponges, which belonged to his father, our first President. Many of these were mounted by, or were from the collection of, the late Dr. Bowerbank, the eminent authority on matters relating to sponges. The collection contains examples of all the principal families of the *Spongiadæ*, and members wishing to study the structure of this interesting and beautiful order of the animal kingdom will derive considerable advantage from carefully looking through it. The Club is also indebted to Mr. Goodman, for some slides chiefly of botanical interest.

A special exhibition of microscopes and microscopic objects was held at the Small Public Hall, on Wednesday, May 28th, under the auspices of the Microscopical Sub-Committee. It was attended by a great many visitors who appeared to spend a pleasant evening, and to be very much interested in the exhibits. The exhibitors were Messrs. Aldous, Baldock, Bayard, Berney, Dr. A. B. Carpenter, Messrs. Collier, Crowley, Epps, Greenway, Hinde, Holmes, Lovett, McKean, Sarjeant, Syms, and Dr. Thompson.

The President (Mr. Lovett), from his apparently inexhaustible collection, made a large display of microscopic slides illustrating zoological, botanical, and geological subjects; also a series of slides illustrating the stages of preparation in fluid and a series of slides "with a history."

He also exhibited a collection of marine objects, illustrating the mode of preserving temporarily in tubes of fluid, and a microscopist's workshop, being the apparatus used in the preparation of objects. Under microscopes he exhibited fully matured eggs of a fish (*Gobius niger*), and a young crustacean (*Porcellana platycheles*), showing plumose mouth organs. Mr. Philip Crowley deserves to carry off the palm for patience, for his section of the entire length of a fox's jaw with the teeth *in situ.*

Several microscopes of old pattern, some dating from last century, and two solar microscopes, were exhibited by various members. These showed in a marked manner the advances which have of late years been made in microscopic construction, and it may almost be said that, considered as an instrument of scientific research, the microscope is now practically perfect.

A very interesting book by Adams, dated 1771, was exhibited by Mr. Aldous, F.R.M.S.

The living objects exhibited were principally aquatic, and, as usual, were regarded by the visitors with mingled feelings of interest and horror, more especially some animalcules from water in which water-cress had been washed for table. Other objects exhibited, were Muller's type slide of diatoms, cat's tongue, hair from beard, wood ants, head of mosquito, leaf of sundew with a captive fly, sections of human tongue, lung, and scalp, diamond beetles, sponge spicules, section of 'gneiss,' by polarised light, silver in the act of crystallising, diatoms on sea-weed, internal casts of Foraminifera, fossil wood, &c., sections of limestone from New Zealand.

Mr. Holmes also exhibited a series of drawings of sponge spicules, and a number of slides of sponges, both marine and freshwater, Foraminifera, and geological specimens, &c.—W. M. Holmes, *Hon. Sec.*

Report of the Zoological Sub-Committee, January, 1890.

Owing to my not having had much opportunity during this last season of collecting in our neighbourhood, and from the fact of the scarcity of insects, there is little of interest for me to report; I will, however, make a few observations on those things which have come under my notice during my rambles. Mature Lepidoptera I found comparatively few of. Larvæ were scarce, with exception of *M. brassicæ* and *M. persicariæ*. It frequently happens that larvæ in June and July are most abundant, so much so that scarcely a leaf is left on the trees; yet very few imagos are the result of this abundance, owing to the thousands of ichneumons destroying the larvæ; this is no doubt a provision of nature to keep down the excess of lepidopterous insects in their larval state; but unfortunately the ichneumons are not wise enough to know when to leave off to please the collector, and the result is that imagos are scarce, to the great discomfort of the entomologist.

Should the weather continue severe,—and we have really a hard winter,—the probabilities are that the coming season will be a good one, as from experience I have always found that after a mild winter the insects are very scarce, and after a hard one they are very plentiful. A mild winter is also very hurtful to hybernating larvæ, as the dampness induces fungoid growth in their bodies, which destroys them; the

larvæ, also, are tempted by the warmth of the season and the sun to come out of their hiding-places, and starve in consequence of their not being able to find food, and many are thus destroyed by birds, mice, and other vermin; the ground being soft, beetles and other underground enemies prey on them; this would not be the case in hard weather, where the ground is hard frozen or covered with snow. We are well aware that some of the larvæ commit great havoc in our orchards. *Chimatobia brumata* is a pest in the Kent orchards, and the fruit growers are trying experiments for their destruction.

In October, 1889, I was visiting one of these orchards, where I found a tenant just commencing liming the trunks of the fruit trees; he had fastened a narrow band of paper tightly round the collars of the trees, just below where the trees began to branch, and this paper he had painted over with some sticky material; the females being wingless were not able to reach the branches, and many were entrapped on the paper. I suggested that, in place of liming the trees in October, he should put it off till the middle of January, as the moths, in the event of the weather proving mild, would deposit eggs till probably the end of December; and by liming the trees in the middle of January all the eggs would be encased in the lime and would therefore not hatch; whereas, if the trees were limed in October the lime would set, and the insects could lay their eggs on it with impunity, and the larvæ would be able to infest the trees. Whether my suggestion has had any beneficial result I am unable to say, as I have not again visited the orchard.

Some time since I prepared some lists of Lepidoptera and had them bound in parts, with a hope that all those members taking an interest in this work should, at the close of each season, insert in those lists the captures of all scarce and new insects taken, say, within 20 miles of Croydon, or even at a greater distance, if it was thought advisable. The lists consist of:—

	Genera.	Species.
Rhopalocera	28	66
Sphingina and Bombycina ...	11	36
Noctuina	93	294
Geometrina	85	272

The remainder consisting of Pyralidina, Tortricina, Tineina, Pterophorina, and Alucitina. I have left the preparation of these lists for those who collect them. If the lists are properly filled in, noting the dates and places of all captures, they may become very useful books of reference to those who come after us.—John Berney, *Hon. Sec.*

Report of the Photographic Sub-Committee, January, 1890.

I have pleasure in reporting that during the past year, the Photographic Section has increased from 43 to 60 members, and that the meetings on the whole have been well attended, especially the lantern evenings.

Eight excursions have been made during the summer, *viz.*:—April 26th, to Westerham; May 10th, to Coulsdon; May 17th, to Horley; June 7th, to Merstham; June 28th, to Guildford; July 26th, to Hever; August 16th, to Caterham; and September 13th, to Upper Warlingham.

The largest muster was to Horley, on which occasion 23 members

responded to Mr. F. W. East's kind invite to the Photographic Section. Mr. East met the party at the station with carriages in readiness to drive them to the various places of photographic interest in the neighbourhood. The route taken was *viâ* Smallfield Place, Dowlands Lane, Burstow, Keeper's Common, across Pot Common on to Worth, thence by way of Three Bridges and Crawley to Lowfield Heath, where we were most hospitably entertained by our kind host.

Technical and conversational meetings have been held on the first Friday in each month throughout the year, and demonstrations on the various branches of photography have been given. Lantern evenings have been held on the third Friday throughout the winter months, and an average of 150 slides have been passed through the lantern on each occasion, a large number of them being of excellent quality.

At the Soirée this Section was well represented, some 25 members exhibiting transparencies and prints, the work shown being of a very high average.

I am glad, in conclusion, to be able to say that this Section is in a more flourishing condition than it ever has been; this is no doubt largely due to the kindness of those members who are always ready to assist and help others who are not so advanced as themselves.—W. Low Sarjeant, *Hon. Sec.*

The excursions of the year are referred to under the Reports of the various Sub-Committees in whose charge they were; except the one on Whit Monday, May 26th, 1890, which was of a general character, partly perhaps archæological, and which was under the direction of our Hon. Secretary, Mr. Bayard. A party of 29 members and friends met at Holmwood Station, and proceeded by lane and field to the old British camp, Austiebury, just above the village of Christchurch: this old earthwork was explored with much interest, and the party descended into Christchurch village, and then ascended to the top of Leith Hill; the view thence was not good as the weather was too hazy. The road then lay through the woods to the picturesque old village of Friday Street, some photographs of which were secured.

The party then crossed the Park to Wotton House, where it was most courteously received by Mr. Evelyn, who conducted the members over the house and grounds showing them the quaint old rooms and halls, the picture gallery with portraits of the celebrated John Evelyn and others of the family. In the museum were a number of valuable objects of interest, the chief being the original manuscript of 'Evelyn's Diary,' and a *Hortus siccus*, or herbarium of mediæval plants collected about 1685 at the Horticultural Gardens at Padua. The gardens and grounds contained many rare and interesting shrubs and plants, as well as interesting relics of John Evelyn, as shown in the bowers, terraces and fountains, arranged or built by him.

After a most enjoyable visit, the members returned to Croydon, part taking the road direct to Dorking, and the rest proceeding

through the fields and bye-paths by Milton Mill and the lower part of Westcott.

During the past year no less than fourteen papers and communications have been read before the Club, and these have been of very general interest.

February 12*th*.—Mr. F. C. Bayard read the Report of the Meteorological Sub-Committee for 1889, which has already appeared *in extenso* in our 'Transactions' (Trans., Art. 78, p. 225). This elaborate and carefully drawn up series of tables not only shows what valuable work is being done by this section and its numerous contributing observers, but reflects the greatest credit upon our worthy Secretary, who is thus conducting two distinct secretaryships, both of which absorb so much time and attention. Mr. Lovett made the following observations on some "Slides of Volcanic Vitreous Dust." This exceedingly minute dust was collected on the ship 'Arabella,' on which it had fallen in Lat. 5.37 S., Long. 88.58 E., Aug. 28th, 1883, 1000 miles from Java. It is considered to be, and in all probability is, from the great volcanic eruption in Java about a little prior to that date. It consists of such extremely comminuted particles that it is capable of floating in the atmosphere for some considerable time; and as it would also be carried by wind currents for great distances, it in all probability caused those strange afterglows, which were so characteristic of the period following the eruption, at sundown. An account of the eruption of Mount Vesuvius, of 1767, states that people in Naples suffered as to their eyes by the dust which then fell, and quite heavy dust fell on board ships 60 to 100 miles off, to the great astonishment of the sailors. It would be interesting to know whether this vitreous dust was in any way injurious to the crew of the 'Arabella,' as minute particles of glass inhaled cause bleeding at the lungs.

March 12*th*.—Mr. Walter Crouch, F.Z.S., &c., of the Essex Field Club, read a paper "On the Physical Conditions of the Sea" (Trans., Art. 79), in which he referred to various marine phenomena—ocean currents, tides, colour, depth, temperature, &c., of the sea, alluding to any localities remarkable for any distinctive features. The great ocean depths and records of all deep soundings were next treated, and such forms of life as exist in such positions described; the expeditions of the 'Lightning,' 'Porcupine,' and 'Challenger,' being quoted in support of the subject. The paper, which from the nature of the subject was rather a lengthy one, was well illustrated by charts and maps for showing the known currents, trade routes, &c., and by diagrams of deep-sea life, and statistics of various kinds connected with the subject.

April 9*th*.—A short paper was read by Dr. G. J. Hinde,

F.G.S., on a "Discovery of Chert containing Radiolaria, &c., in the Palæozoic Rocks," which was illustrated by some sections of chert showing these organisms, which were from Scotland and Spitzbergen. This discovery, which is of great interest, proves the existence in these older rocks of sponge spicules and Radiolarians, which had not hitherto been known to extend so far back as the palæozoic period (Trans., Art. 80). The Rev. Geo. Bailey, F.R.M.S., read a paper entitled "The Tenants of a Fossil *Echinus*," in which he first described the process of cleaning the material for microscopic examination: he then enumerated forty-five species of Foraminifera which he had obtained from a single silicified *Echinus*, all of which he had determined, and which were exhibited on the table. This paper, with lists of species, will be found in our 'Transactions' (Trans., Art. 81).

May 14*th.*—Mr. H. T. Mennell, F.L.S., read a report upon a large collection of Surrey birds recently sold, but fortunately retained in the county (Trans., Art. 82). Several rare specimens were referred to, and the localities where killed mentioned. The risk of losing such local collections as this is a powerful argument in favour of forming a suitable county museum, to which, it would be hoped, all such collections, or individual objects of Surrey interest, would ultimately tend. I read a short paper upon some simple methods of preparing marine objects, especially Mollusca, Crustacea, and Echinodermata, for the cabinet: pointing out that the chief point to keep in view was the retention of form and colour, which could only be done with care and non-exposure to heat or direct sun-light, as the former distorts and the latter bleaches (Trans., Art. 83).

September 10*th.*—The following communications were read, *viz.*:—(1). By Mr. H. T. Mennell, F.L.S., "On the Botany of Snowdon and Cader Idris," in which the very interesting flora of these mountain spots was described and illustrated by a collection of dried specimens (Trans., Art. 84). (2). By Mr. P. Crowley, F.L.S., "On an Abnormal Growth of the Black Poplar," the root shoots of which had forced up a piece of asphalt path, and in its endeavour to grow had become highly subdivided and bifurcated. (3). By Mr. J. Jenner Weir, F.L.S., "On some remarkable points of resemblance between some flies (*Volucella*) and some bees (*Bombus*)," the larvæ of the former being parasitic on those of the latter; hence probably this mimicry for protection, to enable the enemy to enter the nests of the bees and deposit their eggs (Trans., Art. 85). (4). By Mr. Goodman, "On the Geology of the Swanage and Purbeck Districts," in which the interesting strata and fossils of this locality were described (Trans., Art. 86). (5). By Mr. Murton Holmes, "On some Glauconite Casts of Organisms from the Firestone of the Lower Green sand Formation at Godstone," which were of a

remarkable character, and included an abundance of sponge remains (Trans., Art. 87). (6). I gave a short account of "The manufacture of Tappa Cloth in Fiji," which cloth is merely a woody fibre beaten out from the inner bark of the bread-fruit tree after maceration (Trans., Art. 88).

October 8th.—By Mr. W. Murton Holmes on "Sponges." In this paper the lecturer gave an interesting account of the structure of these organisms, especially in regard to their spicules, the forms of which are exceedingly diversified. He illustrated his observations with a large number of well executed diagrams and drawings, and compared recent forms with their fossil representatives (Trans., Art. 89).

November 12th.—I contributed some "Observations upon the Life-history and Habits of the Marine Decapod Crustaceæ of the British Seas." These animals exhibit many points of special interest to the naturalist, and their habits show in various species wide divergences. For example the swimming crabs, *Portunus*, *Polybius*, *&c.*, have the terminal joint of the last pair of legs paddle-shaped, whilst their entire carapace is chitinous and delicate; whereas species inhabiting a rocky shore, such as the genera *Xantho*, *Lithodes*, *&c.*, possess a powerful and heavily calcareous shell. Some species, such as *Pisa*, *Inachus*, *&c.*, are exceedingly sluggish in their movements, and are frequently covered with growths of sponge and algæ: whilst nearly the whole of the *Palæmonidæ* are vivaceous and rapid in their movements. The question of protective colouring is also one of great interest, for whilst almost all species inhabiting estuaries or muddy localities are dull and sombre in tint, those even of the same species, which are obtained from clear water of a granite district and which live amongst brilliant algæ, are almost invariably bright and vivid in their colours. The *Porcellanidæ* are especially remarkable for their wonderful protective adaptation to surrounding conditions. There are also points of great interest in connection with the early conditions of life of these animals, for it is an universal rule that all those species such as *Palinurus*, *Homarus*, *&c.*, which in their primary stages are a prey to fishes, produce ova in enormous masses; whilst those differently situated and which enjoy a certain amount of protection, produce only a small number of ova: of these latter may be mentioned the genera *Axius*, *Gebia*, and *Callianassa*. It is remarkable that the common crab, *Cancer pagurus*, is never as a rule found with ova, and for years I had searched in vain for it. Certain species of Crustaceans live buried in the sand beneath the water, and others burrow in the rough shingle formed by the detritus of granite rocks: of the former *Thia polita* is a good example, and of the latter *Gebia deltura*, whilst *Corystes cassivelaunus* buries its body and waves its long antennæ as a bait

for small fish, which it captures with its long claws. Of the hermit crabs much might be said as to the curious fact of their requiring artificial protection for their soft abdominal segments, whilst the great stone crab, *Lithodes maia*, is an example of a species in a state of evolution from the hermits to the true crabs, and the genera *Galathea* and *Munida* in a transition state to the lobster group. They possess the fifth pair of legs in a pseudo condition only, and *Dromia vulgaris* uses these curious appendages for freeing its carapace from any obnoxious substance. My contributions to the Zoologist, 1881–4, go into this subject more fully.

December 10th.—By Mr. E. Straker on "Changes in the Aspect of our District during Historic Times" (Trans., Art. 90). In this paper Mr. Straker referred to the fact that this subject though of great interest had not been touched by geologists. The chief changes had been wrought by man, domesticated animals, and earth worms, which latter were constantly forming vegetable mould. Prehistoric man being a hunter did little to alter the aspect of the country, but the advent of the Saxons wrought great changes, owing to their three field system and their heavy draught oxen. The lecturer then referred to the Dooms-day Book, as to the distibution of parishes with their proportions of grazing, arable, and wood lands, and pointed out that such allotted areas had in reality not altered to any very marked extent. Mr. Straker concluded with some observations upon the alteration of our flora by the introduction and cultivation of suitable trees, shrubs and plants from other parts of the world.

The Twenty-first Annual Soirée of the Club took place on Wednesday, November 26th last, and its interest and attractiveness were well maintained. Ninty-one microscopes were exhibited by members of twelve different Societies, and some of the preparations shown were above the average of excellence. The Photographic Section of the Club made perhaps the finest display of photographs ever seen in Croydon. These were the work of members, and much taste and judgment were shown in their arrangement, causing them to attract a great deal of attention: a large number of excellent transparencies were also shown. A large series of meteorological instruments of great interest were exhibited by Mr. Stanley; and Mr. Philip Crowley lent his remarkably fine collection of Lepidoptera from the Palæarctic region of the world. My own exhibit consisted of a rather large series of Neolithic arrow-heads and spear-heads from nearly all parts of the world, and made of flint, jasper, chert, chalcedony, carnelian, obsidian, quartz; also celts and their modern representatives from the South Pacific. I also showed the war headdress of eagle feathers, formerly belonging to a chief of the

Cheyenne tribe, which attracted much attention in consequence of the interest taken in the present out-break of these Indians and the Sioux. The basket of flowers, gathered in the open air at Addiscombe on the day of the Soirée, contained 121 varieties collected by Mrs. Lovett: this number is 28 below the previous year, in consequence of the very severe frosts experienced in the earlier part of the month. Mr. Bidwell exhibited a fine series of the eggs of birds, illustrating abnormal forms, marking and colourisation, caused in some cases by immaturity, in others by disease or the imperfect secretion of the colouring matter. Some heads of the celebrated mummy cats from Egypt, were exhibited by Mr. E. Straker, and Mr. Bayard showed some casts of very fine Greek gems, and there were several good series of botanical specimens, fossils, and recent shells, lent by various members, besides a fine trophy of heads and antlers of animals by Mr. Thorpe, and a large number of sundry objects which proved of great interest to our visitors. The total number present was 683, or 53 more than at the previous Soirée, and 7 below that of 1888.

During the year the exhibits at the ordinary meetings have largely increased, and have, I think, given rise to considerable interest at our monthly gatherings. They will be found duly specified later on in this Report. I hope we may have still more during the present year. Almost all objects in nature prompt discussion and elicit information, and nothing is too humble to be beneath notice.

I cannot conclude without some remarks about the future of our Club. In October last, I brought forward a scheme for enlarging the sphere of our Society, and acquiring a large and serviceable suite of rooms, useful alike to all sections and every member of our Club. This scheme, which to succeed required a very general support, failed from reasons with which you are all acquainted, but I still hope that the remarkable cordiality of the support which was accorded to the scheme is an omen that we may yet look forward to the time when something may be done in this direction. As an instance of the way in which my project was received by many of our members, I should like to record here that unsolicited letters of guarantee towards future contingent expenses were sent to me for sums exceeding in the aggregate four hundred pounds; and that a large number of letters were received by me cordially approving of my suggestion; whilst anything like disapproval of the project was conspicuous by its absence. With the growing usefulness of our Society, and the rapidly increasing and valuable work done by our Sub-Sections, we find ourselves out-growing our accommodation.

Our largest and most popular Section at present, owing to the widespread use of the camera, is our Photographic Section with its sixty members. This Section has long felt the want of a dark room where its practical work could be carried on, and where friendly suggestions on the intricacies of developing could be imparted by our experienced to our inexperienced members.

I therefore devoted my attention to obtaining such a room, and found that it was difficult to find anything quite suited to our wants. I discovered, however, on these premises a room which I could see would answer our requirements with certain necessary fittings. Upon application to the Committee of the Institution, I obtained this room for one year from 8th inst., and I have given myself the pleasure of making it useful and comfortable, in which work I have been most kindly assisted by Mr. Waller, who has vastly improved the appearance of the walls.

This room I now beg to hand over to the Club for the use of its Photographic Section for the present year, as a slight proof of the interest I have always taken in its welfare, and as an acknowledgement of the honour I received when I was elected by you to this chair. The particulars of the room, which I hope you will all visit at the close of this meeting, are as follows:—Length 25 ft., width 8 ft. 10 in., height about 7 ft. 6 in. Concrete floor, which I have covered with thick coir matting. Water is laid on, and there is a copious sink. It is heated and lighted by gas: the stove meter, &c., for which however are hired. I have also placed there a table and a few chairs, &c.

Of course this room is practically available at all times, but this will doubtless be arranged by our Photographic Sub-Committee. In the meantime, I would like to suggest that in addition to the fixed photographic meetings, the room shall be open one evening a week for purposes of practical work and comparing notes, and later on if one evening is not sufficient two can be arranged, but it is necessary that the room when open shall be under the charge of someone, and our new Photographic Secretary, Mr. Gower, has undertaken this charge in the meantime. I sincerely trust that this room will meet with the approval of our photographic friends to such an extent that they will want to bring to our Club a number of their friends to enjoy with them its advantages.

In conclusion, gentlemen, I must thank all those who have by their wise counsel and help so kindly assisted me in endeavouring to carry out the responsible position in which you did me the honour to place me; and, whilst feeling a little pardonable satisfaction at our success so far, I venture to express a hope that if all is well this year we may look forward to still further progress, more good practical work, and a largely augmented list of members, in which hope I feel sure I am joined by you all.

Members elected, 1890.

January 15*th.*—M. Hopewell, 79, Lansdowne Gardens. J. E. Morris, Beddington. John Wayte, M.D., B.A., 108, North End. Edwin Webster, 234, South Norwood Hill, South Norwood.

March 12*th.*—Walter Budgen, Elswick Villa, Addiscombe Road. William Henry I'Anson, 120, St. James' Road. Walter James Lovett, Linda Villa, Farquharson Road. James Christie Reid, 43, Addiscombe Road. John Johnstone Reid, 4, Sydenham Road. Alfred Crake Russell, 12A, Clarendon Road. The Rev. George Buchanan Ryley, 177, Lower Addiscombe Road. Charles James Napier Yuill, Marion Villa, Addiscombe Road.

April 9*th.*—Edgar A. H. Field, L.D.S.Eng., 85, High Street. Arthur William Hirst, St. Michael's Road. Edward Hall Grimwade, Norton Cottage, Oakfield Road. Ernest Alfred Patch, The Chestnuts, Havelock Road. Frederick William Purser, 41, Addiscombe Road. St. George C. Reid, Brigstock Villa, Thornton Heath. Simeon Talbot Silvester, Wellesley Road. Alfred Underhill, 23A, Clarendon Road.

May 14*th.*—William Ashcroft, Layham's Farm, Beckenham. J. A. Finney, 57, St. Peter's Road. William Goode, Mulgrave Road, Sutton. H. B. James, The Oaks, near Carshalton. Capt. Mallcott S. Richardson, R.E., Victoria Road, Eltham. William Whalley, Addington Park Farm. Charles Thomas Wilkinson, 21, Brighton Road.

September 10*th.*—Frederick Elliott Annison, Wendouree, Chichester Road. Arless Haydon Carter, Reedham, Purley. David Waller, jun., Ferndene, Warrington Road.

October 8*th.*—William Ritchie Baker, 9, Belmont Villas, Wallington.

November 12*th.*—Frederick T. Edridge, J.P., Addiscombe Court. Harry Fuller, Hollymount, Duppas Hill. John Privett, Amsworth House, South Park Hill Road. Spencer E. Whealler, 9, Friend's Road East.

December 10*th.*—The Rev. George Albert Brock, 41, Selhurst Road, South Norwood. Robert Wylde Church, Rydalmere, 50, Birdhurst Road. Henry Clark, 2, Ventnor Villas, Waddon-New-Road. William Challoner Cutler, Derwent Bank, Upper Addiscombe Road. Arthur Francis Harland, 32, Park Lane. Thomas George Walter Hoole, 25, Birdhurst Road. Walter C. Norton, Maycourt, Campden Road. Vincent John Shute, 144, Birchanger Road, South Norwood. James Wenham, 29, St. John's Grove.

Library and Collection.

The additions to the Library and Collection during the year 1890 are as follows:—

From Individuals.—F. C. Bayard: Comparison between the Jordan and Campbell-Stokes Sunshine Recorders. W. H. Beeby: Flora of Shetland. Dr. A. Carpenter: Duplicate numbers of Club's Reports and Transactions; Simon's Public Health Reports, 2 vols.; Vital Statistics, 1 vol. Thomas Cushing: British Association Pamphlets. C. H. Goodman: 3 doz. Microscopical Slides. W. Murton Holmes: 3 doz. Microscopical Slides. Harry Lee: 270 Microscopical Slides made by the late Henry Lee. Rev. E. S. Marshall: A Collection of Rare

Surrey Plants. Prof. O. T. Mason of Washington, U.S.A.: Sundry Pamphlets. Prof. J. Prestwich: Relation of the Westleton Beds of Suffolk to those of Norfolk, in 3 parts. C. L. Prince: Summary of a Meteorological Journal. E. B. Sturge: Excursion arrangements of London Geological Field Class 1888, and Kew Bulletin for July 1889. N. Waterall: Darwin's Journal during the Voyage of the 'Beagle,' and Darwin's Coral Reefs' Volcanic Islands and South American Geology.

From Societies.—La Société Belge de Microscopie: Bulletin, 6me Année, Nos. 1, 2, 3, 4, 5, 7, 8, 9, 10, 11, and Annales Tome xiii. 3me Fascicule, and Tome xiv. Berwickshire Natural History Club: Proceedings. Brighton and Sussex Natural History and Philosophical Society: Reports for 1888, 1889, 1890. British Association: Report, 1889 (Newcastle-on-Tyne). Eastbourne Natural History Society: Transactions, Vol. 2, Part 3. Essex Naturalist: 4 numbers. Hampshire Field Club: Proceedings, No. iv. Holmesdale Natural History Club: Proceedings, 1888 and 1889. Manchester Microscopical Society: Transactions and Annual Report, 1889. Oldham Microscopical Society and Field Club: Report for 1889. Quekett Microscopical Club: Journal, 1 number. Reading Literary and Scientific Society: Reports for 1889 and 1890. Royal Microscopical Society: Journal, 5 numbers. South Eastern Naturalist: Vol. 1, Part 1. West Kent Natural History Society: Proceedings, 1889.

From Proprietors.—Science Gossip.

Loan Collection.—Dr. A. Carpenter: Palæontographical Society, Vol. xliii; Royal Society, Proceedings, Vol. xxi.

Exhibits, 1890.

February 12th.—E. Lovett, A series of Sea Urchins (Echinodermata), including *Echinus sphæra*, *Sphærechinus brevispinosus*, *Spatangus purpureus*, *Echinus flemingii, &c.;* Slides of vitreous volcanic dust from the Krakatoa Eruption. C. H. Goodman, Specimens illustrating the anatomy of insects; also slides and microphotographs of insects. Ernest Straker, 3 heads of mummified cats from Egypt. E. O. Newman, Head of a mummified cat from Egypt. K. McKean, Land Mollusca. Dr. Franklin Parsons, Recent and fossil echinoderms. Dr. Hinde, Fossil echinoderms. H. D. Gower, Engravings of fish. W. L. Sarjeant, Diagrams of vitreous volcanic dust drawn by means of the camera lucida; also slides of some of the same dust under his microscope. W. Murton Holmes, Sections of spines of echinoderms under his microscope; also polished section of calculus from horse.

March 12th.—F. C. Bayard, Thermometers for registering the temperature at various depths in the ocean (lent by Messrs. Negretti & Zambra). C. H. Goodman, marine sponges, zoophytes, &c. W. Crouch (to illustrate his paper), Charts, maps, photographs, engravings, &c., to illustrate various marine phenomena. E. B. Sturge, Specimens of the shore in the locality of John O'Groat's, N.B. K. McKean, Tests of Foraminifera and drawings of living organisms. W. L. Sarjeant, Dredgings, Mid-Pacific, 2425 fathoms (H. M. S. 'Challenger'). R. J. Backwell, Soundings, 1860 fathoms, N. Atlantic. Dr. A. B. Carpenter, Diatom ooze, 1950 fathoms, Antarctic (H. M. S. 'Challenger'). W. Murton Holmes, Soundings from depths varying from 1300 to 4428

fathoms. E. Lovett, Micro-slides of deep-sea soundings and surface fauna; a large series of various materials forming the ocean bed; also objects and appliances made and used by North American and Eskimo Indians, together with photographs and drawings illustrating the natives themselves.

April 9th.—E. Lovett, Primitive oriental fire-making appliances, including various steels with flint, agate, quartz, jasper, &c., tinders and tinderholders, &c., from Thibet, and Northern and Central India, and a fire compression tube from the Katcheens of Bhamo, Upper Burma; also a series of polished stone axes (British). Dr. G. J. Hinde (to illustrate his paper), Slides of sections of chert containing Radiolarians. Rev. G. Bailey (to illustrate his paper), Slides of *Frondicularia, Cordai*, and other organisms from interior of a fossil *Echinus*. P. Crowley, A large series of butterflies, Parnassius group, of the Palæarctic regions. W. Murton Holmes, Glass-rope sponges (*Hyalomena sieboldii*), from Japan. H. T. Mennell, Plant of tooth-wort (*Lathræa squamaria*) parasitic on the hazel, from Warlingham. N. Waterall, Fragments of lava from Mt. Vesuvius.

May 14th.—P. Crowley, A collection of bird-skins to illustrate Mr. Mennell's paper. E. Lovett, A collection of fish-hooks of bone, stone, shell, wood, bronze, and iron, to illustrate development in form and material; also a moth (*Hemerophila abruptaria*), shown as an illustration of protective colouring. K. McKean, An ephemera (*Choroterpes picteti*) mounted in balsam without pressure. C. H. Goodman, Cast skin of *Chironomus plumosus*, showing respiratory tufts.

September 10th.—H. T. Mennell, Dried plants from Snowdon and Cader Idris, to illustrate his paper. P. Crowley, Abnormal growth of black poplar. J. Berney, Living larvæ of Lepidoptera, including some of the rarer species. W. Murton Holmes, Specimens of Godstone chert and firestone. J. Jenner Weir, Dipterous insects mimicking humble bees (Hymenoptera). C. H. Goodman, Fossils, &c., from Swanage and Purbeck District. E. Bailey, Tin ore. N. Waterall, Model of a gondola, &c. G. Mordaunt, Fetish ornaments, Ashantee box of elephant skin from Cape Coast Castle. E. Lovett, Tappa cloth, kava bowls, tappa hammers, food dish, shark hooks, &c., from Fiji; also bow and arrows and barbed arrow-heads from pigmies of South Central Africa.

October 8th.—W. Murton Holmes, Drawings (to scale) of sections of sponges, spicules, &c., to illustrate his paper. W. L. Sarjeant, Gamboge containing a number of ants embedded in the matrix; these probably fell into the bamboo tube which was collecting the resin. E. Lovett, Certain shells, showing the uses to which they were put; also a Strombus used as a fog-horn by the Normandy fishermen; also a Cassis, showing cameo cut on its surface; also shells used by the Chinese as windows.

November 12th.—E. Lovett (to illustrate his paper), 24 cases of specimens of British marine decapod Crustaceæ. W. Murton Holmes, Fossil fish teeth, &c., from the chalk of Croydon, and various recent sponges. J. Epps, Jun., Specimen of razorbill caught in October, on Blackfriars Bridge, London.

December 10th.—E. Lovett, Sketch of abnormal mushroom; also Tropical crustacean, and *bêche-de-mer*.

Croydon Microscopical and Natural History Club.—Balance Sheet for the Year ending 31st December, 1890.

Receipts.

	£	s.	d.	£	s.	d.
Balance, 1st January, 1890... ...				9	5	8
Subscriptions for the year 1888 ...	2	0	0			
" " " 1889 ...	11	10	6			
" " " 1890 ...	118	4	0			
" " " 1891 ...	5	10	6			
" " " 1892 ...	1	0	6			
" " " 1893 ...	0	10	0			
				138	15	6
Sale of Transactions...				0	7	0
Sale of Soirée Tickets				17	10	0
Don. to Meteoro. Sub-Committee...				1	1	0
				£166	19	2

Expenditure.

	£	s.	d.
Rent of Club Room	10	0	0
Hire of Rooms for Meetings	6	14	0
Printing and Stationery	17	11	11
Postages (including £2 12s. 6d. in hand) ...	17	8	4
Soirée Expenses	51	1	2
Meteorological Sub-Committee, 1889 grant ...	5	5	9
Meteorological Sub-Committee, 1890 grant ...	18	17	10
Photographic Sub-Committee	3	2	7
Attendance and Collecting Subscriptions ...	8	11	6
Assistant Secretary	2	17	0
Gratuities	1	6	0
Sundries	3	13	10
Balance, 31st December, 1890	20	9	3
	£166	19	2

SPECIAL FUND.

	£	s.	d.
Balance, 1st January, 1890	25	15	1
Dividends on $2\frac{3}{4}$ per cent. Stock	5	13	0
	£31	8	1
Balance at Banker's, 31st December, 1890 ...	£47	12	1

	£	s.	d.
Cost of 12 Transparency Screens	4	5	3
Balance, 31st December, 1890	27	2	10
	£31	8	1
Invested in $2\frac{3}{4}$ per cent. Stock	£210	11	8

KENNETH McKEAN, *Treasurer.*

We, the undersigned, having examined the above Accounts and the Vouchers relating thereto, hereby certify that they are correct, according to the Vouchers and the Banker's Pass Book.

W. J. ALLBRIGHT,
HARRY D. GOWER, } *Auditors.*

January 6th, 1891.

TRANSACTIONS

OF

THE CROYDON MICROSCOPICAL AND NATURAL HISTORY CLUB.

1890–1.

79.—Physical Conditions of the Sea.

By Walter Crouch, F.Z.S.

(Read March 12th, 1890.)

Mr. Crouch, after stating that the sea had always been a subject of great interest, not unmixed with awe, referred to some of the ancient myths regarding it, quoting from several early writers to support his remarks. Coming to our own day, he alluded to the various expeditions that had been fitted out to explore its depths, test its temperatures, and examine its fauna, of which the following were mentioned:—The cruise of the 'Lightning,' between Oban and Faroe Islands and a portion of the N. Atlantic, in 1868; the cruises of the 'Porcupine' of 1869–70, the latter part of which was devoted to the Mediterranean. The greatest expedition, however, was that of the 'Challenger,' extending from Dec. 7th, 1872, to May 24th, 1876, and sailing 68,890 nautical miles, with a total of 362 observing stations, the general results of which expedition are now pretty well known.

The lecturer then reviewed the general distribution of land and water, stating that Prof. Dana concludes that the present continental and oceanic areas began with the very commencement of the solidification of the crust of the earth; and although changes, upheavals, re-depositions, &c., are going on, and have been from all time, they do not do more than modify the surface, and do not appear to have altered its main disposition. Having referred to ocean depths, he stated that the greatest yet sounded in the Atlantic was 3875 fathoms, and in the Pacific 4475 fathoms, the greatest depths being found near volcanic

islands. As regards density, it had always been assumed that such would largely increase at extreme depths, but it now appears that it scarcely increases at all beyond 2000 fathoms.

Referring to tides, and consequently including "bores," he said that in the Amazon, at the equinoxes, for three successive days they have five waves from twelve to fifteen feet high, which follow one another regularly up the river; and as to the general circulation of the ocean, Sir W. Thompson had said, "We have now good reason to believe that the indraught of water at a low temperature into the Atlantic and Pacific from the southern seas is to a great extent due to an excess of precipitation over evaporation in the *water* hemisphere, and a corresponding excess of evaporation over precipitation in the *land* hemisphere. . . . . That, in fact, a part of the circuit of general ocean circulation passes through the atmosphere.

Mr. Crouch then passed on to ocean temperatures, and their causes. It had been estimated by the 'Challenger' expedition that the direct rays of the sun penetrated to a considerable depth, probably in clear water to 600 ft. Highest recorded temperature, 90° in Red Sea. The temperature of the sea falls very slowly from 39° to 28·4° (its freezing point), because its whole depth cools together.

Touching upon the composition of the ocean-bed and the *Globigerina* ooze of the Pacific, he alluded to the continuity of the deposit of the chalk, as shown by the various forms, tests, and remains from this grey ooze. In the channel between the Caroline and Ladrone Islands, at a depth of 4575 fathoms, the bottom was of red clay, binding together the siliceous tests of Radiolarians and Diatoms. The lecturer, in describing the colour of the sea, said that the true normal colour, as may be seen in the Tropics and in the Mediterranean, is of a deep rich blue; but this may change to purple, red, brown, yellow, to even black. Dr. Carpenter was of opinion that the peculiar blue colour of the Gulf Stream was probably due to the very finest particles of river silt from the Mississippi. Colour is often caused, too, by the nature of a shallow bottom.

The Red Sea owes its tint to a series of minute Algæ, which at times give it the appearance of clotted blood. This Alga, *Trichodesmium*, Prof. Moseley describes as like minute fragments of chopped hay. It has also recently been observed that the density of sea-water has a most important bearing upon the question of colour, and that frequently the brown waters of a river will flow for many miles over the clear blue waters of the ocean without mingling, owing to the great difference in density. In Arctic seas, the masses of pelagic life alter the colour to such an extent that whalers are able to tell the locality of whales by this presence of their food.

In conclusion, Mr. Crouch referred to the luminosity of the sea, which in our latitudes is caused by the presence of myriads of a minute Protozoa, *Noctiluca*, but in tropical regions to Pyrosoma, Tunicata, and even fishes themselves contribute to the display. Prof. Moseley, of the 'Challenger,' is said to have written his name luminously with the tip of his finger when dipped into the phosphorescent sea.

80.—Discovery of Chert containing Radiolaria, &c., in the Palæozoic Rocks.

By Dr. Geo. J. Hinde, F.G.S.

(Read April 9th, 1890.)

Dr. Hinde commenced by giving a brief description of what chert was, and its geological position. Although allied closely to flint, it is of a much more impure character, and its fracture is not so conchoidal, but flatter; it also occurs, not in nodules, as in the case of flint, but in bands, and often in large rock masses. It occurs largely in the lower greensand beds, Tilburstow Hill, near Godstone, being a good locality; it also occurs in the Portland beds of the Oolitic series, in the carboniferous limestone, &c.

Dr. Hinde then exhibited and described some specimens of chert from some beds far older than the above, *viz.*, from those of palæozoic age. The localities whence these were derived were chiefly Scotland and Spitzbergen. Sections of these were made, and examination of them by the microscope revealed the presence of sponge spicules and Radiolarians, which had not hitherto been known to extend so far back as this geological period. It was evident that many organisms which from their delicate structure were subject to destruction might have existed during early geological times in beds where no trace of them exists; whilst others, as in this case, owe their preservation to the protective agency of silica.

81.—The Tenants of a Fossil Echinus.

By the Rev. Geo. Bailey, F.R.M.S.

(Read April 9th, 1890.)

Some time ago, whilst waiting at the Farningham Road Railway Station, having half-an-hour at my disposal before the train

was due, I looked over the chalk-pit close by, and secured two or three specimens of *Micraster*. These fossil *Echini*, however, had been too long exposed to changing atmospheric influences to fit them for use as cabinet specimens: for they had not been in my possession many months before the tests fell in fragments in the tray where they were kept, leaving me only so many casts of chalk instead of complete specimens of *Echini*. Although somewhat disappointed at the time, I took one of these masses of chalk that had replaced the living substance formerly occupying the now broken shell, and prepared it for microscopic examination. It soon became evident that, in losing the specimen I had vainly hoped to preserve, I had gained a most interesting addition to my store of cretaceous Microzoa.

The shell of the *Echinus* had been occupied by a large number of Foraminifera, and these tenants of the fossil shell were in a splendid state of preservation. Some of these were by no means easy to clean perfectly, especially such as had any roughness of outline or any spiny projections, for they were coated with amorphous silex.

No less than forty-five species of Foraminifera are observable on the slides available for inspection this evening, and some of them are of special interest. Prof. Jones, in his 'Catalogue of the Fossil Foraminifera in the British Museum,' gives a list of the Foraminifera of the chalk and chalk-marl of England. Amongst the tenants of this *Echinus* are three species of *Lagena*, two species of *Cristellaria*, one species of *Textularia*, one species of *Bigenerina*, and one species of *Truncatulina*, not included in the above list.

Unfortunately I am at present unable to identify with certainty all the species to be seen on these slides, yet the generic features are placed beyond reasonable doubt. The list of Foraminifera attached to these notes is as complete as practicable from the very limited source herein indicated. Chalk taken from outside the fossil I am referring to contained other Microzoa which were not found inside the specimen; for example, sponge-remains were plentiful outside, but not inside, only a few small fragments of spicules and two or three gemmules being found within the shell. Polyzoa were not wanting outside, but scarcely a trace was visible inside.

Two remarkable organisms are indicated on slides No. 1 and 14. They are circular, and at first I took them to be something akin to the so-called wheels of *Chirodota*; but I was impressed with the fact that the spaces between the spokes were not open, but solid. I showed a more perfect specimen than either of these preserved to Mr. Carruthers, of the British Museum, and after a careful examination he gave it as his opinion that it was undoubtedly a Diatom, rendered somewhat obscure by the

amorphous silica which covered it. Unfortunately, through neglecting to have the slide containing the specimen just referred to, flat instead of resting on its edge, the slide was spoilt, and the specimen lost. Then there is another obscure specimen that I am inclined to think may prove to be a *Polycystina*. Soon after I had noticed this example in slide No. 21, my attention was called by the Editor to a note in Ann. & Mag. Nat. Hist. for July, 1883, from the pen of Dr. Wallich, who had discovered three, if not four, genera of *Polycystina* in a flint from Surrey. Anyhow, I regard it as a *Polycystina* until it be successfully disputed. Single valves of two species of *Entomostraca* were among the finds in this prolific *Echinus*. Then again, coccospheres and coccoliths were in great abundance, but they are so very minute as to render them unpopular for general inspection.

The coccospheres are small round sarcodic bodies, and coccoliths are minute oval discs that are sometimes seen attached to coccospheres, but they are much more commonly seen separately. Messrs. Sorby, Huxley, Wallich, and others have studied them, but they have not yet agreed in defining them, and so we must wait until more is known about them.

List of Tenants in the Fossil Echinus.

Foraminifera.

Textularia agglutinans, D'Orb.
,, *baudouiana*, D'Orb.
,, *globosa*, Ehr.
,, *sagittula*, Defr.
,, *trochus*, D'Orb.
,, *turris*, D'Orb.
,, 5 spp.
Bigenerina capreolus, D'Orb.
Spiroplecta biformis, P. & J.
,, *rosula*, Ehr.
Verncuilina triquetra, Munst.
Bulimina presli, Rss.
Bolivina, several spp.
Lagena apiculata, Rss.
,, *globosa*, Mont.
,, *sulcata*, W. & J.
Dentalina, several fragments only.
Frondicularia cordai, Rss.
,, sp. ?
Vaginulina legumen, Linn.
Cristellaria crepidula, F. & M.
,, *cultrata*, Montf.
,, *rotulata*, Lam.
,, *variabilis*, Rss.
,, 2 spp.
Polymorphina, 2 spp.
Globigerina cretacea, D'Orb.
,, *bulloides*, D'Orb.
,, *linneana*, D'Orb.
,, *marginalis*, Rss.
Sphæroidina bulloides, D'Orb.
Discorbina, sp. ?
Truncatulina lobatula, W. & J.
,, *muellerstorfi* ? Schw.
Anomalina ammonoides, Rss.
Ramulina aculeata, D'Orb.
Rotalia, sp. ?
Nonionina, sp. ?

Various Organisms.

Diatom? or more probably a wheel-shaped spicule.	Sponge spicules.
Entomostraca, 3 spp.	,, gemmules?
Polycystina.	Coccospheres, abundant.
	Coccoliths, very abundant.

82.—Report upon the Stafford Collection of British Birds recently sold at Godalming.

By Henry T. Mennell, F.L.S.

(Read May 14th, 1890.)

Towards the end of last February there appeared in the 'Pall Mall Gazette,' and other London papers, paragraphs describing a collection of birds to be shortly disposed of by auction at Godalming. These notices excited the interest and curiosity of many of us. The collection was stated to be the work of a lifetime, and to contain a vast number of rarities. From the catalogues which appeared shortly afterwards, it was seen that the collection was that of Mr. William Stafford, of Godalming, deceased. The sale took place on March 5th, 1890. The first lot in this catalogue was thus described:—

"Lot 1.—The beautiful collection of birds, the greater part of which are British species, as made and set up by the late Mr. W. Stafford, the well-known naturalist of Godalming. This museum has been formed after sixty-five years' personal interest and perseverance. Most of the birds have been obtained in the neighbourhood of Godalming and Guildford, and many have a history attached to them, which increases the interest and value of this fine and nearly complete local collection. The scenery at the back of each case, painted by Mrs. Stafford, is in keeping with the nature and habit of each example, and the setting up of the collection is altogether artistic."

It consisted of 332 cases of birds, and the catalogue was much more elaborate, careful and correct than is usual for country auction sales. It was afterwards ascertained that it had been copied from a catalogue prepared by Colonel Godwin Austen when the collection was exhibited at Guildford in a Loan Art Collection some years ago, and no doubt pains were then taken to verify the details given, the name of the author being a guarantee that this would be done. The localities were given for the rarer species, as well as some interesting particulars of their capture.

Mr. J. B. Crosfield and I spent a day in carefully going over the collection, and, as far as possible, verifying the species. We

were permitted by Mr. and Miss Stafford, the son and daughter of the collector, to inspect a MS. catalogue, which in some instances gave fuller details than those in the printed catalogue, and it appeared to us to add considerably to the confidence to be placed in the authenticity and origin of the specimens. Miss Stafford assured us that, though many of the specimens were not killed by her father, but had been obtained by gift or purchase, all had been obtained in the flesh, and skinned and set up by him.

Mr. Stafford was a corn-dealer at Godalming, and had converted the large barn-like upper story of his warehouse into a museum. The cases of birds covered the walls all round, and the long tables in the centre; and the beams and rafters of the roof were covered with a miscellaneous collection of armour, weapons, pictures, and curios of every description; of these it would be easy to say much, and interesting details might be recorded of many found in or connected with the history of the county.

Our notes must, however, be limited to the birds, and chiefly to those shot in the county. We could form no estimate of the value of the collection, or the price it was likely to fetch; but we were anxious that, if it should go at a moderate price, it should be secured for the county, and not dispersed; and we were prepared to run the risk of purchasing it with this object. Happily our efforts in this direction were not needed, as it was eventually secured by the authorities of the Charterhouse School, where it will be added to their museum at Godalming. The first bidder, either with assumed or real simplicity, put in the collection at 10*s.* a case, remarking that he was no scholar, and must leave it to the auctioneer to work the sum. This was equivalent to £166, and it was ultimately knocked down to the representatives of the School at £400—a very handsome price, and far beyond what we had anticipated.

Some want of confidence in the authenticity of the records of habitat, &c., have been expressed by authorities whose judgment we should respect. The grounds for this distrust appear to be that so many rare species had fallen into Mr. Stafford's hands, and were stated to have been got in the neighbourhood of Godalming; but this difficulty is much reduced when we consider that they include the casual or occasional visitants of sixty-five years, and that the neighbourhood is one likely to be rich in birds from its varied character, abundant water, extensive woods, and reasonable proximity to a long line of coast.

It was also alleged that Mr. Stafford had obtained many specimens from Leadenhall Market; this is true, but the fact that these are carefully labelled as such, both on the cases and in the catalogue, adds to, rather than detracts from, the authenticity of those stated to have been killed in the locality. Scepticism is a

very useful and important habit of mind to the naturalist, but it must not prevent him from accepting reasonable evidence. On the whole we come, after very careful consideration, to the conclusion that few collections would better stand the test of investigation than this one.

We will now proceed to note the rarer and more interesting species killed in Surrey, taking them in the order of the catalogue, extracts from which are in all cases given in quotation marks:—

Case 16. Black Redstart, *Ruticilla titys* (or *tithys*).—"Killed in Ockford Road, Godalming, when the ground was covered with snow, in 1855." This bird is a summer visitant to Central Europe, and occurs not very unfrequently on the south coast of England in winter; it has, however, occasionally been known to nest in Britain.

17. Blue-throated Warbler, *Cyanecula suecica*.—"Killed at Wandsworth, Surrey, May, 1862." This specimen has the *white* blotch on the throat, and is therefore the bird known as *Cyanecula leucocyanea*. This form has very rarely been met with in Britain.

17a. Another specimen, in full plumage.—"Killed at Guildford Castle; presented to Mr. Stafford by Mr. W. Bridger." According to Harting, there are three forms of this bird, which have all received different names:—(1st). *Cyanecula suecica*, the eastern and northern form, with a red spot in the centre of the blue. This is the form that has usually occurred in Britain. Harting, in his 'Handbook of British Birds,' from which I take these particulars, records about a dozen instances of its capture, widely distributed over the island. (2nd). *Cyanecula leucocyanea*, the western and southern form, with a white spot in the centre of the blue. This is the ordinary Dutch and German form, and might therefore be expected to be the commoner visitant here. Of this form, however, Harting only records one occurrence, *viz.*, in the Isle of Wight, 1865 to 1867 (resident all that time). (3rd). *Cyanecula wolfi*, which has the entire throat blue. This is the rarest form in collections; it is said to be more common in Russia. Some authors, however, regard the birds with the wholly blue throat as merely sports or chance varieties of the white-spotted form, and the specific name *C. wolfi* is by some of these given to the latter, including under it both the white-spotted and wholly blue forms.

30. Pair of Fire-crested Wrens, *Regulus ignicapillus*.—No locality given in catalogue. Shot by W. C. Stafford, son of the collector. These birds should be carefully examined and identified.

38. Thrush-like Warbler or Great Reed Warbler, *Salicaria arundinacea*.—"Shot at Ockford Pond, Godalming, in 1858, by Mr. J. P. Stafford" (son of W. S.). Harting states that the nest of

this bird has been found in Surrey, Kent, Hants, Herts, and Northamptonshire. The bird has also occurred near Newcastle and elsewhere. It breeds in Central and Southern Europe, wintering in South Africa.

44. ALPINE WARBLER OR ACCENTOR, *Accentor alpinus*.—"Shot at Milford, in the winter of 1841, hopping about stone-heaps at the road-side, and mistaken for a large Hedgesparrow." Harting gives about a dozen occurrences in Britain, in widely scattered localities. This bird inhabits the higher mountain regions of Southern Europe. In North Europe and Britain it is a rare straggler.

47. BEARDED TITMOUSE, *Panurus biarmicus*. — "Shot in the neighbourhood of Godalming, where it is now rare." On referring to the MS. catalogue, it appeared doubtful whether the actual specimens in this case had been killed at Godalming, but Mr. Stafford makes a note in his diary that he has had specimens so killed; and other specimens have from time to time occurred in several other localities (as the Isle of Wight, Devonshire, Cornwall, &c.) distant from the fens of the eastern counties, where it is resident.

55. CRESTED TITMICE, *Parus cristatus*.—"One specimen killed at Hampton Lodge by Mr. Long." This bird is resident in the north of Scotland; it has only very occasionally occurred in England.

58. WHITE-WINGED WAGTAIL, *Motacilla alba*. — "Shot near Broadwater, Godalming, in spring plumage, by Mr. J. P. Stafford."

61. BLUE-HEADED YELLOW WAGTAIL, *Motacilla flava* (usually called the Grey-headed Wagtail).—"Shot by W. Stafford." An occasional summer visitant: it has bred in Northumberland.

69. Pair of GOLDEN ORIOLES, *Oriolus galbula*.—"Killed near Oxenford Bridge, Puttenham, by Mr. Jones, farmer, of Elstead." This beautiful bird breeds in Central and Southern Europe, and winters in South Africa. In England it is a rare summer visitant; the nest has been found several times in Kent.

70. GREAT GREY SHRIKE, *Lanius excubitor*.—"Killed at Haslemere by Mr. Hedgecock, of Stroud Farm." Inhabits Northern and Central Europe in summer, and winters in Southern Europe.

74. WOODCHAT SHRIKE, *Lanius rutilus*.—"This rare specimen was killed at Milford by R. Upfold." The nest has been found in the Isle of Wight. A more southern bird than the last-named, wintering in South Africa.

75A. WAXWING, *Ampelis garrulus*, Linn.—"Killed in Peperharrow Park, winter of 1849." This beautiful bird appears irregularly, or at long intervals, in considerable abundance in Britain in the winter; it breeds in the pine-forests of the Arctic circle.

77. PIED FLYCATCHER, *Muscicapa atricapilla*, Linn. — "Uncommon in Surrey; killed at Witley Park, near Godalming."

84. Pair of Siskins, *Fringilla spinus*, Linn.—"Found in winter near Godalming, feeding on the seeds of the alder." Breeds in Scotland. I have seen them in summer in Mar Woods, on the Dee, above Braemar.

89. Pair of Tree Sparrows, *Passer montanus*.—"Shot by W. Stafford."

102. White-winged Crossbill, *Loxia bifasciata*.—"This rare specimen was shot at Munstead Heath, Godalming, by J. P. Stafford." A native of Northern Europe and Asia. It has occurred pretty frequently in Britain. Yarrell also records it from Surrey.

108a. Ortolan Bunting, *Emberiza hortulana*. — "Shot at Godalming; a rare bird in Surrey."

108a. Ortolan Bunting, *Emberiza hortulana* (female).—Caught at Peckham by a birdcatcher.

112. Pair of Lapland Buntings, *Emberiza lapponum*.—"Killed during very severe weather at Mousehill, Godalming, in company of a flock of Sky Larks, by Bone, huntsman to Lord Middleton." "An irregular winter visitant," Harting.

115. Rose-coloured Pastor, *Pastor roseus*. — "Killed while feeding on cherries in Busbridge Gardens; presented by —. Wilder, Esq., of Busbridge Hall." This interesting bird breeds in Southern Europe. In winter it is found in India.

116. Chough, *Pyrrhocorax graculus*.—"Shot at St. Catherine's Hill, near Guildford." This bird was formerly resident in Sussex and the Isle of Wight, but is not now found breeding east of Dorsetshire.

117. Nutcracker, *Nucifraga caryocatactes*.—"Shot by J. Wood, farmer, Elstead, about 1839." Several instances are recorded of its occurrence in Surrey, *e. g.*, in the 'Letters of Rusticus,' "Near Pepper Harrow Park, Godalming, and near Guildford."

124. Raven, *Corvus corax*.—"Shot by George Chitty, Chiddingfold."

130. Pair of Shore Larks, *Alauda alpestris*. — "One shot on Merrow Downs, Guildford; two others were killed at Petersfield, and presented by Thos. Jones, stage-coachman." This bird frequents the shore in winter only; in the summer it lives in high mountain regions.

136. Pair of Great Spotted Woodpeckers, *Picus major*, Linn. —"Shot at Westbrook, Godalming."

144. Hoopoe, *Upupa epops*, Linn.—"Shot in front of Busbridge Hall." In the MS. note-book is a record, "This specimen was shot at Hambledon, near Godalming; several have occurred." This note apparently refers to a specimen sold separately (Lot 113 in catalogue) for 20s.

162. Pair of Marsh Harriers, *Circus æruginosus*.—"One bird was killed at Elstead, 1847; the other at Frensham, in the same year; presented by J. H. Frankland."

164. Montagu's Harrier, *Circus cinerarius*.—"This bird was picked up dead on Royal Common, Godalming, in the winter of 1840." (A note refers to its having a nest and four eggs, which is not quite consistent with the time of year, unless it was found dead on its nest.)

165 a. Pair of Buzzards, *Buteo vulgaris*.—"Both specimens were killed at Witley when nesting; presented by the Master of Witley Workhouse." An event not likely to be repeated, we fear, now-a-days.

166. Rough-legged Buzzard, *Buteo lagopus*.—"Killed near Busbridge and Munstead; presented by R. Munro, Esq."

170 a. Pair of Goshawks, *Astur palumbarius*.—"This bird was caught in a trap near Godalming by Mr. Swanley. The bird on the right was shot near Chiddingfold by Mr. Burdock."

176, 176 a. Honey Buzzard, *Pernis apivorus*.—"Caught in a trap on Lea Park, Godalming, in successive years." This bird, though rare, has been recorded as occurring in a considerable number of counties.

176 b. Honey Buzzard, *Pernis apivorus*.—Shot at Pepperharrow by Lord Middleton's keeper, Lee."

180, 180 a, 180 b. Peregrine Falcon.—"The first shot at Munstead Heath, Godalming, in 1849; the second caught in a rabbit-trap at Puttenham in 1835; the third shot at Munstead Heath, 1849 (a female of second year)."

181 a. Pair of Hobbies, *Falco subbuteo*.—"The male was killed on Pound Hill, Godalming; the female at Binscombe."

182. Merlin, *Falco æsalon*.—"Shot near Godalming, May 10th, 1870, by Mr. Dykes, gamekeeper."

183, 183 a. Red-footed Falcon, *Falco vespertinus*.—"The male shot at Compton, near Godalming, in 1871. The female at Binscombe." Harting quotes from Meyer a record of the occurrence of a pair of these birds at Claremont, near Esher, Surrey.

186. Pair of Ospreys, *Pandion haliætus*.—"One specimen was shot at Hammer Pond in 1843; the other at Abbot's Pond, Frensham."

189. Pair of Gannets, *Sula bassana*.—"One was found in an exhausted state near Frensham Pond, 1840; the other was killed at Linchmere, near Haslemere, 1844; it had dropped in a stubble-field, and a boy killed it with a stick; sent by Rev. H. Baker." This bird does not breed nearer than Lundy Island, in the Bristol Channel.

195. Squacco Heron, *Ardea comata*.—"Killed at Vachery Pond." Harting records about twenty instances of its occurrence in Britain.

196. Little Bittern, *Botaurus minutus*.—"Killed at Bramley; sent by Mr. W. Matthews, of Bramley."

198, 198A. BITTERN, *Botaurus stellaris.* — "Male killed at Elstead; female at Eastney Bridge."

197. NIGHT HERON, *Nycticornix griseus.*—"One specimen was killed at Bramley." This bird no longer breeds in Britain, but is a pretty regular annual visitant.

202. SPOONBILL, *Platalea leucorodea.*—"Shot at Vachery Pond, Cranleigh, in the summer of 1839; sent by Mr. Piper, of Guildford."

205. BEAN GOOSE, *Anser segetum.*—"Shot a little below Godalming Wharf by a bargeman in 1841."

207. WHITE-FRONTED GOOSE, *Anser albifrons.* — "Shot near Godalming, Unnstead Old Water, in 1841."

209. BRENT GOOSE, *Anser bernicla.*—"Shot near Godalming in 1852."

210. BARNACLE GOOSE, *Anser leucopsis.*–"Shot nr. Elstead, 1849."

216. COMMON SHELDRAKE, *Tadorna vulpanser.* — "Killed at Frensham Pond; sent by J. H. Frankland."

217. RUDDY SHELDRAKE, *Tadorna rutila.*—"Found dead in a ditch at Farnham by J. Knight." A very rare bird in Britain, and the possibility of its escape from captivity makes the records of its occurrence always questionable.

222. Pair of GADWALLS, *Anas strepera.*—"The male was killed at Elstead, 1850; the female at Hammer Ponds, 1850, by J. R. Grevell."

227. Pair of SHOVELLERS, *Anas clypeata.* — "Shot at Cosford Pond in spring, by J. Hawkins, Esq." Usually only a passing migrant, but occasionally breeding. I have myself taken its nest at Prestwick Carr, near Newcastle-on-Tyne.—H. T. M.

230. Pair of SCAUP DUCKS, *Fuligula marila.* — "Killed at Hampton Lodge, Elstead." A winter visitant in this county.

232. FERRUGINOUS or WHITE-EYED DUCK, *Fuligula ferruginea.*— "Killed at Bramley, and sent to Mr. Stevens, Poulterer, Guildford." "A spring visitant to the eastern counties of England from the Thames to the Humber," Harting.

233. Pair of GOLDENEYES, *Clangula glaucion.* — "One shot at Chiddingfold; one at Thorncombe Swell, near Godalming." A winter visitant.

241. COMMON SCOTER, *Oidemia nigra.*—"Shot near Godalming Wharf during a very severe winter."

244. Pair of GOOSANDERS (male and female), *Mergus merganser.* —"Killed at Ockford Pond, Godalming."

245. Pair of RED-BREASTED MERGANSERS, *Mergus serrator.* — "Shot at Fleet Pond, 1843." This bird breeds in Scotland and Ireland; in England it is only a winter visitant.

246. HOODED MERGANSER, *Mergus cucullatus.* — "Killed at Elstead." This is a North American bird, very occasionally occurring in Britain. Yarrell records it from Sussex.

247. Pair of Smews, *Mergus albellus.* — "Killed at Sir W. Magney's Mills, Alberry."

256. Barbary Partridge, *Perdix petrosa.* — "Shot at Puttenham by Mr. Carey."

258a. Virginian Colius, *Ortyx virginianus.*—"At one time well known near Godalming as American Partridge." No doubt the result of an attempt to introduce or acclimatize the bird on the part of some landowner in the neighbourhood.

264. Baillon's Crake, *Crex bailloni.* — "This rare bird was caught at the spring in Church Street, Godalming (before the water was carried off by an underground drain), by a man named Rainbow, a leather-dresser, 1837."

267. Little Crake, *Crex pusilla.*" — "Shot by Mr. Jefferies, Gunmaker, Guildford, at Mr. Sheyer's farm, Bramley, in 1860."

275, 275a. Great Plover or Stone Curlew.—"One killed at Compton; the other at Puttenham, in a rabbit-net."

283. Ringed Plover, *Ægialitis hiaticula.*—"Shot at Vachery Pond, Cranleigh."

285, 285a. Dotterel, *Eudromias morinellus.*— "Bought from the landlord of the Seven Thorns Inn, Hindhead, in the spring of 1845."

287. Turnstone, *Strepsilas interpres.* — "Killed at Hammer Ponds, near Godalming."

290. Black-winged Stilt, *Himantopus candidus.* — "Found dead near Vachery Pond, Cranleigh, 1845." Gilbert White records the occurrence of six of these birds at Frensham Pond, Hants in 1779; and in Zool. 1856, p. 5041, its occurrence in the same locality, in 1832, is recorded.

294. Pair of Great Snipes, *Gallinago major.*—"Shot between Guildford and Godalming, 1850."

295a. Sabine's Snipe, *Gallinago sabini.* — "From Elstead." This bird is not recognised as specifically distinct from the Common Snipe by many authorities.

305. Purple Sandpiper, *Tringa maritima.*—"Shot at Milford, at Mr. Webb's pond, and bought from Robert Upfold."

306. Pair of Knots, *Tringa canutus.*—"Shot at Broadwater in 1832."

307, 307a. Ruff and Reeve.—"Killed near Godalming, Aug. 1836; and one in 1840, with several others."

308a. Sanderling, *Calidris arenaria.* — "Shot at Liphook." This is in Hants, but very near the boundary of Surrey. On another case of this species it states, "Several specimens killed at Putney Bridge," but does not say that the specimens in the case were among them.

312. Pair of Green Sandpipers, *Totanus ochropus.*—"Killed at Catteshall Farm, Godalming, by W. Arnold."

313. Wood Sandpiper, *Totanus glareola.*—"This rare specimen was killed at Catteshall in 1857."

315. Spotted or Dusky Redshank, *Totanus fuscus.*—"Shot at Forked Pond, near Godalming, in 1853."

316. Pair of Greenshanks, *Totanus glottis.*—"Killed on Godalming Peasemarsh."

319. Black-tailed Godwit, *Limosa ægocephala.* — "Shot at Down Land, Liphook, in 1840." This is just over the county boundary, in Hants.

321. Whimbrel, *Numenius phæopus.* — "Killed at Thursley, near Godalming."

325. Roseate Tern, *Sterna dougallii.* — "Killed at Vachery Pond, Cranleigh, 1873."

332. Pair of Whiskered Terns.—"Shot at Hampton Lodge; from H. Long, Esq."

334A. Pair of Black Terns. — "Shot at Hampton Lodge; presented by H. Long, Esq."

343. Greater Black-backed Gull, *Larus marinus.* — "One specimen was found in a stubble-field at Milford, exhausted; brought to Mr. Stafford by James Milton, employed on road."

346A. Little Gull, *Larus minutus.*—"Four of these were shot at Battersea."

346D. Little Gull, *Larus minutus.*—"Shot at Battersea."

346E. Little Gull, *Larus minutus.* — "Shot at Walton-on-Thames."

350A. Richardson's Skua, *Lestris parasiticus.* — "Killed at Wonersh by Mr. Head, bailiff to Lord Grantley."

352. Storm Petrel, *Procellaria pelagica.* — "First, Milford, nr. Godalming, 1840." "Second, Wormley Hill, found dead, 1837."

353. Fork-tailed or Leach's Petrel, *Procellaria leucorrhea.*—"First, Rodborough Hill, Godalming." "Second, Killed on Hindhead." "Third, Found dead at Haslemere."

354, 354A. Wilson's Petrel, *Procellaria wilsoni.*—"Killed on Godalming Peasemarsh, after a very severe storm." "Two others were killed a few days after, in the same place."

355. Manx Shearwater, *Puffinus anglorum.* — "Killed at Aldershot; one from B. Hampton, the other from —. Catfield."

362A. Great Northern Diver, *Colymbus glacialis.*—"Female was shot at Broadwater." "Caught near Godalming" is on the case itself.

365, 365B. Great Crested Grebe, *Podiceps cristatus.*—"Shot at Forked Pond, Godalming." "Shot at Frensham Pond in 1837."

366. Red-necked Grebe, *Podiceps rubricollis.*—"Bird in winter plumage killed at Toseley."

367. Dusky or Slavonian Grebe, *Podiceps cornutus.*" — "Shot at Cosford Pond."

868, 868A. Eared Grebe, *Podiceps auritus.*—"Male, Hammer Pond, 1840; female, Forked Pond, 1840."

375. Little Auk.—"Taken at Haslemere; from W. Scofield." "Four others have passed through the hands of W. Stafford within forty years, that have been procured in this immediate neighbourhood."—Extract from MS. note-book.

376, 376B. Puffin, *Fratercula arctica.* — "Hascombe Pond, Witley; and Highdown Ball."

We have thus records of just 100 species which seem worth noticing as being of more or less rarity and interest. It is a goodly list, no doubt. Some of the more critical and difficult species may probably need closer examination, and more exact knowledge, than we could give them on our hasty inspection. As the collection is happily to be kept together in a public institution, this examination will not be difficult. I hope the MS. notes of Mr. Stafford have gone with the collection, and will be preserved; these notes should be carefully compared with the labels on the cases, many of which are becoming barely legible through age.

83.—Some Suggestions for Collecting and Preserving Specimens of Marine Animals.

By Edward Lovett.

(Read May 14th, 1890.)

The following observations may be of some value, as they are the result chiefly of actual experience, and have been found of practical use to the author.

There are very few coast localities that are absolutely useless as collecting grounds, but of course some places are exceedingly rich in marine fauna, whilst others are poor; yet it often happens that an unfavourable locality is productive of varieties and abnormal forms from the very fact, that it is an unfavourable locality. As regards localities rich in marine life, the Channel Islands, and the shores of Cornwall, Devon, Sussex, South Wales, and the Farne Islands may be mentioned. It is worth while, if possible, to be also near a fishing town, especially where dredging-boats work, as a bushel of refuse brought in by such a boat will often contain a large quantity of rare things, and more than one addition to the British marine fauna has been obtained from the refuse of a "scallop" dredge. The work of dredging can of course be done by the collector himself, and needs no description; but, where a dredge cannot be obtained,

a useful substitute in weedy localities is a small grappling-anchor with a safety line, in case of fouling, to which also may be added hempen tangles; the grapple used from a small boat will tear off and bring up large algæ, &c., whilst the tangles will often cling to Echinoderms and Crustaceans, and thus bring them to the surface.

Shore hunting requires but little advice, but, as a rule, it is good to take the advantage of a spring tide, when ground can be examined that is not often exposed. In rocky localities, like the Channel Islands, when a big spring tide sometimes enables the naturalist to walk out for four miles over the bed of the sea, the wealth of marine life is to be seen in great profusion. Large loose rocks may be turned over to great advantage, as many rarities are seldom seen in the light, but hide away in the small hollows beneath ledges and boulders. Sand-banks may be dug for boring Mollusca and Crustaceans, and beds of *Zostera* or sea-grass are always sure to yield numerous forms of all orders. For this kind of work wading is absolutely necessary, and the tide should be followed down; but it should always be remembered that it is necessary for safety to turn before the tide does. An ordinary angler's fish-basket does very well for taking home the larger specimens, using *Zostera* or Algæ to prevent damage by shaking. Small bottles or tubes containing a fluid of one part alcohol, one part glycerine, and two parts water, does for the temporary carriage of microscopic organisms, into which they should be put alive. A small knife and a small pair of forceps, which may be safely carried by sticking the blade and the points into a cork, which can be tied to a coat-button, should be taken; a small hand-net is all else that is really required.

Having returned to lodgings after a good day's sport, a few words as to preservation of the various specimens may be of use. The Mollusca (with shells) may be put on one side if necessary, as they do not require immediate attention as do others. But when they can be attended to, all that is required is to put them into boiling water, remove contents carefully, wash and dry the shells, and, in the case of bivalves, tie them up, or they will dry gaping. The sea-urchins and star-fishes (unless very minute specimens) should be put into sea-water to revive them; when the spines have assumed the natural erect position, take them out and put them quickly into methylated spirit (which need not be fresh for each lot), and leave them to soak for one or two days; this will harden the integument, and when the contents are removed, the spines will remain firm; star-fishes treated in this way harden with judicious drying.

The Crustaceans perhaps are the most difficult to preserve, as in most cases spirit injures the colour, whilst light and heat altogether destroy it. The specimens are most easily treated by

putting them into a bucket of fresh cold water, and should be kept in the dark; this will kill them, and in a few days partially decompose the flesh, when it can be readily removed by cutting off the carapace. When all the contents of the shell have been cleaned out (or as nearly as possible), the specimen should be washed in cold water, a little powdered alum sprinkled over the interior only, and the specimen may then be set out on a board and dried. The drying may be done in an outhouse or where there is a current of dry air, excluded from sun-light or too much heat. When quite dry and rigid, the specimens may be freely dressed with spirit of turpentine in which a very little gold size has been mixed; this preserves the specimens from insects, damp, and decomposition, and gives them a slightly moist appearance without the objectionable glaze of varnish. This treatment is also applicable to sea-urchins and star-fishes.

As regards the preparation of the microscopic material that has been collected, that has already been described in a paper by me before this Society.

84.—Notes on the Plants of Cader Idris and Snowdon.

By H. T. Mennell, F.L.S.

(Read Sept. 10th, 1890.)

Last July I spent a fortnight with my sons in North Wales, making the two mountain masses of Cader Idris and Snowdon our centres. Both are composed of palæozoic sedimentary rocks, which have been subjected at two distinct periods to violent volcanic disturbance, throwing up vast masses of felspathic lavas, volcanic ash, and scoria. Cader Idris has been mainly affected by the earlier volcanic outburst; Snowdon, of which it was the centre, by the later. Columnar porphyry is seen in the grand cliffs of Llyn-y-Cau, on the south side of Cader Idris. Whether it be the geologic formation, or whatever be the cause, there can be no doubt that these mountains are less rich than those of Scotland in their alpine flora, and are somewhat disappointing to the botanist.

The alpine flora of the world, or of the northern hemisphere, is wonderfully uniform,—whether it be on the summit of the Grampians, the Scandinavian Fjelds, the Siberian Tundras, or the Rocky Mountains or White Mountains of the New World. This uniformity bespeaks a great antiquity for this flora, and is evidence of a time when the whole of the northern hemisphere was under more or less glacial conditions.

This flora now maintains a struggling existence only on the

mountains, where the less hardy but much more vigorous and aggressive flora of the lowlands cannot follow it; and it may be that the warmer winter climate of the Welsh Alps, open to the warm Atlantic gales, enables this lowland flora to flourish at a higher elevation, and to wage war successfully with the alpine plants, and this may account for the comparative poverty I have alluded to.

On the wet rocks of Llyn-y-Cau, below Cader Idris, on the fine crags of Cwm Glas and of Crib-y-disgail, parts of Snowdon, as well as on the slopes of the Glydrs, and especially in the chasms of Twll Dhu, many of the most striking and beautiful of our alpine favourites may, however, be found in abundance. Of these, the most noticeable are *Saxifraga oppositifolia*, *Silene acaulis*, *Rhodiola rosea*, with many varieties of the mossy saxifrage, *Saxifraga hypnoides* and its forms, mingled with some less distinctly alpine plants, such as *Trollius europæus*, the globe flower; a very erect short stiff form of *Geum rivale*, *Thalictrum montanum*, and others. A handsome mountain variety of the common thrift also attracts attention. The parsley fern is very abundant on both mountains, as also is *Lycopodium alpinum;* and the filmy fern, *Hymenophyllum wilsoni*, clothes the wet rocks about the waterfalls.

In mountain pools, on the flat ground above the Devil's Kitchen, we found the curious aquatic crucifer, *Subularia aquatica;* and on the bare rocky ribs, running down from the base of the Glydr Fach to the Devil's Kitchen, a few plants of *Hieracium holosericeum*, the only one of the "*alpinum*" section of the hawkweeds we noticed. This genus is much less abundant, both as regards species and individuals, than in Scotland or the North of England. The most abundant species at a high elevation on both mountains, but especially on Cwm Glas, was *Hieracium bifidum*, one of the several species formerly included under *H. pallidum*. On slaty *débris* on lower levels, near Tal-y-Llyn, Cader Idris, a form was found, which may prove to be *H. ovarium*, a species very recently identified as British.

I was much interested in observing on the hill sides above Bethgelert, and also, though less conspicuously, elsewhere, "Fairy Rings," as they are called, formed entirely of *Lycopodium alpinum*. One of these that I measured was 16 yards in diameter, the outer ring was absolutely perfect, and like a box-edging; inside the ring were scattered plants of the *Lycopodium*, much less vigorous, and many of them withering.

From the botanist's point of view, however, our best find was *Alisma*, or *Elisma natans*, in a lakelet near Dolgelley. This very rare and interesting plant grows in two or three feet of water; at the base, rooted in the mud, is a tuft of slender grass-like leaves, thence rise to the surface slender delicate pedicels,

surmounted in some cases by beautiful oval floating leaves, about two-thirds of an inch long, like those of a *Potamogeton;* in others, by pure white three-petalled flowers, also floating on the water. The slender thread-like stalks, curled and twisted, follow the rise or fall of the level of the water, so variable in mountain lochs. In the same water was a peculiar form of *Juncus supinus,* with very slender flaccid leaves and stalks, perfectly erect, and without runners; the flower-heads very small, and with a distinct pinky colour, reminding one of *Epilobium* buds. It is *Juncus fluitans,* Lamarck.

85.—On some points of Resemblance between certain Diptera and Hymenoptera.

By John Jenner Weir, F.L.S., &c.

(Read Sept. 10th, 1890.)

Since Mr. Bates drew attention, many years ago, to the mimicry of one species of butterfly by another, the subject has received considerable attention from those who delight in the philosophy of natural science; and his hypothesis that the model was a species inedible by birds or lizards, and that the edible obtained a certain amount of impunity from their attacks, by its deceptive resemblance, has received general acceptation.

The insects in the box, herewith, illustrate another kind of mimicry, inasmuch as they are species of Diptera, or two-winged flies, which feed on the larvæ of hymenopterous humble-bees.

The whole of the specimens exhibited are of one species, but it will be seen that the four upper closely mimic the common humble-bee, *Bombus terrestris;* the three in the centre, the red-tailed humble-bee, also a very common species, *Bombus lapidarius.* The single specimen, at the bottom of the box, illustrates imperfect mimicry; the specimen is black, like the mimic of *Bombus lapidarius,* but its abdomen at the extremity is of a whitish yellow instead of red, in this respect more resembling the mimic of *Bombus terrestris.*

It is very probable, as pointed out in the 'Entomologist's Monthly Magazine,' by Colonel Blathwayt, that this mimicry enables the flies to deceive the bees, and thus pass into their nests and deposit their eggs in the comb, where the larvæ of the flies are parasitic on those of the bees.

The subject is a very interesting one, and should be further investigated, in order that it may be ascertained that the dimorphic forms of the Volucella do really affect the nests of the two species of bees they respectively resemble.

One thing is quite certain, that the flies are parasitic upon the bees; and it is remarkable that they should, undetected, obtain admission into their nests, when it is well known that so many Hymenoptera detect not only intruders of other species, but even of their own species of another colony, and ruthlessly expel them.

At the same time it is well to remark that there are several genera of "Cuckoo-bees," which are parasites in the nests of other bees, feeding on the food stored up by their industrious hosts; and the species above mentioned, *Bombus lapidarius*, has a red-tailed cuckoo-bee parasitic upon it.

86.—Notes on the Geology of the Isle of Purbeck.

By C. H. Goodman.

(Read Sept. 10th, 1890.)

That part of Dorsetshire lying S. of the River Frome and Poole Harbour, and known as the Isle of Purbeck, is about 14 miles long by 7 wide, and presents many features of geological interest. The most conspicuous is a great central chalk range running E. and W., on one point of which Corfe Castle stands. On the north side extends the low-lying Bagshot sands, and here is preserved an interesting local object. Situated on a low hill, and conspicuous on the moorland, is the "Agglestone," computed to weigh 400 tons. It is a hard concretionary block, left after the denudation of the surrounding soil.

Passing now by steamer round the eastern extremity of the chalk range referred to, deep indentations in the coast can be traced, also stacks already isolated by the sea, and others in the process of formation. The strata are horizontal, but near the southern side exhibit a most striking contortion, being suddenly bent up to a vertical position. The recess beyond forms Swanage Bay, composed mainly of the Wealden clays and Hastings sands. Lyall says it cannot be less than 2000 feet thick; it is productive of reptilian remains, and the usual bands of lignite. A small stream flows into the bay through the town; and it may be worth recording that I here found *Gyrinus urinator*, hitherto unknown on the south coast.

Parallel with the chalk, and forming the southern boundary of the valley, is the ridge from which the island takes its name, and which gradually dips eastward, terminating in the projecting rocks, called Peveril Point. The beds are divided into upper, middle, and lower Purbeck. The upper produces the well-known Purbeck marble, a fresh-water limestone containing Paludina,

Although retaining its beauty under protection, it soon loses its polish exposed to the atmosphere. The middle contains numerous layers, fresh and marine. Several species of mammalian remains have been found in this section; but the most conspicuous feature is the "cinder" bed, 12 feet thick, composed of a mass of *Ostrea distorta*, and which can be well studied in Durlston Bay. Shells of *Cyrena* also occupy another thin bed. The lower Purbeck is remarkable chiefly for its "dirt" bed, with its remains of Cycads and coniferous trees. Layers of gypsum can also be well seen from the shore.

The quarries from which the Purbeck stone is dug are scattered all along the hill side above the town, and consist of sloping well-like holes of no great depth, up the sides of which the blocks are drawn by a windlass. Sheds for squaring the curbs and flags stand by the mouth, and the whole is generally surrounded by a low wall. Each quarry is worked by two or three men; and I was informed by an intelligent native that the trade is fast dwindling down, owing to the clannish and conservative habits of the miners, who resist any change or suggestions for co-operation and improved machinery. Many of the quarries that I visited were unworked, which seemed to bear out the statement.

At Durlston Head we come to the Portland stone, a tongue of which extends eastward to this point, and forms a facing to the Purbeck. It is well seen all the way to St. Aldhelms Head, about 5 miles distant. The cliffs, though not high, are vertical, rising abruptly from the sea and exhibiting square-shaped caves, and are the haunt of many sea-birds. Some open quarries of this stone exist along the coast, and produce huge ammonites and oysters. In smooth weather boats can be moored alongside, and the stone lowered directly into them by a crane.

On some of the hill sides in this neighbourhood are a number of artificial parallel terraces. The only suggestion I can find as to their origin is in a paper, by Canon Isaac Taylor, describing the cultivation of ancient lands by ridges. Whatever the ground formerly produced, it is now only used for sheep grazing.

Beyond St. Aldhelms—or St. Albans Head, as it is sometimes called—the land recedes to Chapman's Pool, which is the entrance to a deep narrow gorge running inland. At the base of these hills appears the celebrated Kimmeridge clay, gradually rising westward, and productive of many fossils. Large ammonites are very abundant, and may be seen projecting from the cliffs. Many species of marine shells exist, and where the clay is hard splits up easily, showing their remains, but generally in a fractured condition. One species, however, *Astarte* ...., I obtained in a better condition, as it appears to be always imbedded vertically to the line of cleavage. On the shore I picked up part

of the jaw of a plesiosaurus, or long-necked sea-lizard, and also an elephant's tooth; but the celebrated elephant bed(?) lies further west, which I was unable to explore.

The western boundary of the Isle of Purbeck is Luckford lake and stream; the latter rises in the grounds of Lulworth Castle, and flows into the Frome river, thus bringing us to the point from which we started.

87.—Glauconite Casts from Godstone Firestone.

By W. Murton Holmes.

(Read September 10th, 1890).

I thought it would be interesting to the members of this Club, who took part in the excursion on the August Bank Holiday, if a short account were given of the microscopic structure of the firestone rock, quarries of which occur near Godstone, and were visited on that occasion.

In December, 1886, Dr. Hinde read a very complete paper on the same subject, so complete, in fact, that I find, on comparing my own notes with it, he has already forestalled all I have to say; but there are doubtless some present who have not seen the original paper, and it will be well to re-state some of his conclusions:—

"Firestone belongs to the upper greensand formation, and is well shown between Godstone and Merstham. When first quarried it is soft and earthy, but becomes much harder by exposure to the air. It varies in colour from a whitey-brown to a bluish tint, but under certain conditions it occurs as a soft cream-coloured powdery material, very light, and throughout filled with minute tubes. This kind is more particularly shown at Farnham, and the nearest equivalent to it is at Merstham in the yellowish decayed rotten-stone. The cavities are really the negative casts of sponge spicules, that is, the spicules have been dissolved, and only their minute impressions in the soft matrix remain. This matrix is nearly entirely composed of minute discs or spherules of soluble silica, and seems therefore to have been derived from the solution of the spicules."

Dr. Hinde found spicules representing each of the four principal groups into which sponges are divided. After treatment with acid (which in my particular specimen caused brisk effervescence, indicating the presence of lime carbonate), and subsequent washing, the particles are ready for mounting for examination. The most conspicuous objects in the field are numerous short rod-shaped bodies of an emerald-green colour,

interspersed with irregularly shaped siliceous particles thickly covered with the discs or spherules already mentioned. Here and there may be seen the internal casts of foraminifera and sometimes the spicule of a sponge that has not been entirely broken up, but they are not so evident as in some selected specimens. We find a very similar structure in chert, which occurs abundantly at Tilburstow Hill. Chert is easily splintered into fragments sufficiently thin to show its structure when mounted in Canada balsam. Such splinters often exhibit the internal casts of sponge spicules very perfectly, but the outer siliceous skeleton of the spicule itself has either been entirely dissolved away, or become merged in the matrix of the chert so as to be indistinguishable. Parts of the chert show numerous circular markings, and it seems to me that these were originally spherules such as we find in the firestone, which have continued to grow by accretion of silica until they have overlapped each other, and a solid stone is the result. So far as I can see this appears to be the only difference between chert and firestone. We know that hydratid silica is soluble in alkaline carbonates, which are only partially decomposed by the silica dissolved, and it is owing to this fact that almost all spring, river, and sea water contains silica in solution in minute quantities. When aided by heat, as in the geysers of Iceland, large quantities are dissolved and deposited as a petrifaction on surrounding objects as the liquid cools (Miller). In this way probably the harder rocks have been formed.

We will now turn our attention to the green bodies before mentioned, and try to trace their origin. These consist of a mineral composed of silica and iron known as glauconite. At Oamaru, New Zealand, there are large deposits of a chalky-looking substance, which is composed of sponge spicules, diatoms, Radiolaria, and Foraminifera. The cavities of the sponge spicules in some of the specimens that I have examined contain vermiform bodies composed of glauconite, and which appear to have been derived from the solution of the spicule walls and subsequent deposition in another form, for we frequently find these bodies in spicules almost closed at both ends, with the exception of the small canal aperture; and, as their specific gravity is greater than the original spicule, it is only to be expected that they will occupy less space. Hence the cavity is never perfectly filled. The Foraminifera, after treatment with acid, frequently leave perfect siliceous casts of the interior of their shells.

The question arises, are these glauconite casts formed previously or subsequently to the upheaval of these beds? The evidence that I can offer is not conclusive. I have examined sponge spicules dredged from great depths (3000 fathoms), and have not

seen any with glauconite casts. They have exhibited in abundance circular depressions, which in some cases communicate with the central canal, and are sometimes so numerous that the spicule is almost broken up. The central canal itself is frequently hollowed out in various forms, but no sign of glauconite. On the other hand, I have some Foraminifera dredged from no great depth in the Macassar Straits, which exhibit perfect casts of a siliceous mineral. On the whole I think that the evidence is in favour of their being formed through the medium of water.

In conclusion, as their composition is so similar, we may regard firestone as an immature form of chert, and the beds at Oamaru as immature forms of firestone.

88.—Native Cloth, Fiji Islands.

By Edward Lovett.

(Read September 10th, 1890.)

One of the most primitive kinds of cloth perhaps ever made is that manufactured and used until very recently by many of the islanders of the South Pacific, but whence it is now almost entirely displaced by Manchester goods and other cheap fabrics. This very remarkable material, which is known as "tappa," is made chiefly from the inner bank of the bread-fruit tree, *Artocarpus incisa*, a native of the islands and of the Indian Archipelago. This bark is very fibrous, and the *modus operandi* is as follows:—A huge block or log of hard, well-polished wood lies in an open-sided shed; the upper surface of the log is convex, and on this is laid the fibrous bark, which is beaten with grooved mallets of iron-wood by women who sit in rows on each side of the log. Originally only two or three inches wide, by beating and welding together, very large sheets of this cloth are produced, many feet square.

The patterns and colouring are also very curious, the former being of the most primitive form known, and the latter being always some native pigments of black or brown. The pattern is produced by means of perhaps the most original stencil plate known, *viz.*, a plantain-leaf with the desired marks cut out on it; this is laid on the cloth, and the crude colour brushed or smeared over it.

A superior kind of cloth is made also from the paper mulberry, *Broussonetia papyrifera*, the young branches of which are macerated in water, and beaten and welded together, as in the case of the bark of the bread-fruit tree.

89.—Fresh-water Sponges.

By W. Murton Holmes.

(Read October 8th, 1890.)

Although fresh-water sponges resemble many marine forms in constitution and general appearance, they differ in one or two important points; for, whereas amongst marine species we find some with calcareous and some with siliceous spicules, while others possess a skeleton of horny fibres, the skeleton of fresh-water sponges, upon which the sponge-flesh or sarcode is supported, is invariably composed of siliceous spicules slightly connected together by means of firmer sarcode. The main divisions of the skeleton are made up of several spicules lying side by side, and sometimes overlapping at their ends, the smaller divisions consisting either of a single spicule or of smaller bundles. These spicules in different species vary in size and shape, and are sometimes more or less spiny, but these differences are not by themselves sufficiently constant or positive to serve as a means of classification.

Another particular in which fresh-water sponges differ from marine is the presence, at certain seasons, of peculiar bodies known as statoblasts or gemmules, which have never been found in sponges of marine origin. These gemmules are about $\frac{1}{50}$ of an inch in diameter and nearly spherical, and are found either in continuous layers, as at the base of encrusting species, or singly in the interspaces between the skeleton spicules, or in groups of a dozen or less scattered through the sponge mass, or in smaller groups enveloped in a compact cellular parenchyma. They consist of a compact mass of protoplasmic granules enclosed in a chitinous or horny envelope, having a circular orifice known as the hilum, or foraminal aperture, which is sometimes plain, but more frequently has a slightly raised and expanded margin, or prolonged into cylindrical or funnel-shaped tubules. The chitinous coat is surrounded by a crust composed of air-cells, sometimes very minute, and in other species easily visible under a low magnifying power.

In all the genera of fresh-water sponges, with the exception of Spongilla (which are surrounded by acerate or cylindrical spicules only), a number of peculiar spicules are found embedded in this crust in a radial direction, and their varying forms constitute the basis of the classification now adopted.

Another form of spicule, but occurring in some species only, is the dermal or flesh spicule, which exists in more or less abundance on the outer dermal film, or lining the canals in the deeper portions of the sponge. They are always much smaller

than the skeleton spicule, and are never bound together in any way.

Fresh-water sponges, when living, are generally of a green colour, more especially when growing in situations fully exposed to the light, and from this cause might be mistaken for vegetable growths. They are principally met with in running water (the finest specimens will always be found where there is a strong current), and are attached to stones, pieces of floating wood, roots, and submerged branches of trees, &c. Muddy water is fatal to them.

The classification generally adopted is one based on the system of Mr. H. J. Carter, F.R.S., a short account of which I will now give:—

Group *Spongillina.*

Char. Bearing seed-like reproductive organs called statoblasts or gemmules.

This is divided into seven genera, *viz.*:—

1. *Spongilla.* Gemmules surrounded by acerate or cylindrical spicules alone.

2. *Meyenia* (named after F. J. F. Meyen, who first discovered the birotulate spicules in 1839). Gemmules surrounded by birotulate spicules of a single class or type; diameter of rotules equal or nearly so.

3. *Heteromeyenia.* Birotulates of two classes or types, both resting by one rotule on the chitinous coat; the less numerous class longer than the other.

4. *Tubella* (a little trumpet). Birotulates with rotules unequal; the larger rotule on chitinous coat.

5. *Parmula* (a little buckler). Spicules with distal rotule entirely eliminated.

6. *Carterius* (after H. J. Carter, F.R.S.) Foraminal tubules prolonged, their tubules broadly funnel-shaped, or divided into cirrhous appendages of varying numbers and lengths.

7. *Uruguaya* (from River Uruguay). Provisionally constituted on the supposition that gemmules were not developed. These have since been discovered by Dr. Hinde with spicules similar to *Meyenia leidyi*, but he considers that the cylindrical form of the skeleton spicules and their peculiar arrangement in the skeleton, and the greater solidity of these sponges, give this genus characters sufficiently distinct to mark it off from other fresh-water sponges.

Although this system of classification, based on the form of the gemmule spicules, has many advantages, it may be questioned whether it is, strictly speaking, a natural one, for we find even in the same gemmule many spicules which exhibit a tendency to pass into a form belonging to those of another genus, thus

proving that all the known existing species must have descended from a much smaller number, if not from a single primitive form.

A few words now upon the function of the gemmules or statoblasts.

Fresh-water sponges are much more liable than marine to great variations of temperature. Ice would probably kill the parent sponge. They are also liable to be left dry at certain seasons, for Mr. Bates, in his book, 'The Naturalist on the Amazons,' states that in one part of the river the difference in level between the wet and dry seasons amounts to 25 or even 35 ft., that the floods last from three to four months, and when the water retires "the trunks and lower branches of the trees are coated with dry slime and disfigured by rounded masses of fresh-water sponges, whose long horny spiculæ and dingy colours give them the appearance of hedgehogs."

Another writer (Dr. Rusby) states that sponges on the River Ibon are deposited on branches, and resemble the mud nests of ants and bees.

Some provision is therefore necessary for the continuance of the species, and these gemmules are admirably adapted to withstand extremes of cold and drought, the outer crust of air-cells being a good non-conductor.

When placed under conditions favourable for germination the protoplasmic contents "pass through the foraminal aperture, spreading out on every side. In a few hours the infant colony may be seen producing aqueous currents, developing and arranging skeleton spicules, and in every way living the life of a young sponge" (Potts).

In preparing the spicules for microscopic examination, I have found the most satisfactory way to be, to boil three or four gemmules in a watch-glass with three or four successive drops of nitric acid until they are perfectly disintegrated; then treat with liquid ammonia, which dissolves the altered animal matter, and finally wash very carefully with distilled water.

The gemmule spicules, together with gemmules made more transparent by partial destruction with nitric acid, the normal sponge and dermal film are all the elements necessary for determining the species.

As might be expected, America has hitherto yielded by far the largest number of known species, 58 or more being known, besides varieties, and of these only about three or four have been found in England.

This subject is exhaustively treated in a monograph by Edward Potts, of Philadelphia, which has been of considerable use to me in the preparation of this communication.

90.—Changes in the Aspect of our District during Historic Times.

By E. Straker.

(Read December 10th, 1890.)

The subject of the few notes I have put together for my paper to-night is the "Changes in the Aspect of our District during Historic Times."

We have heard in this room able and interesting papers on the geological changes that have taken place in our district, but, as a rule, the geologist considers his task complete when he has investigated and demonstrated, as far as he is able, the formation and history of the main geological strata. He traces the various changes that have taken place in geologic time, but when the earth had assumed the same general aspect as we now see, and man had appeared on the scene, he considers his task finished. In fact, it much reminds one of our school histories, which always ended somewhat thus: "1837, accession of Queen Victoria, whom may God preserve"; and leave all more modern events unrecorded.

To my mind this interval between geologic time and the present has a great deal of interest, and, from a biological point of view, great importance. The condition of the surface of the soil, whether it be down, heath, common, or woodland, meadow or arable, whether it be wet or dry, has a very marked influence on its flora, and, as a necessary consequence, on its fauna.

Any attempt to trace this history must necessarily be almost entirely conjectural; I must therefore beg your indulgence for my theories, as I find it extremely difficult to trace any definite historical record on these subjects.

I do not think that the chalk-hills, which form the greater part of the area of our district, were at any time densely wooded, although I have no doubt they were fairly covered with scrub and brushwood, with here and there a stretch of turf. The extreme thinness of the layer of earth on the surface of the chalk is in itself strong evidence of this. On such downs as Riddlesdown and Farthing Down, which, I have no doubt, remain exactly in their primeval condition, the only tree of any size is the yew, the extremely slow growth of which must require but little annual sustenance. On the clay soils north and south of the chalk we have evidence of the existence until comparatively recent times of dense forests, consisting mainly of oak. The woods, like those of the weald at this day, were intersected by many watercourses, and interspersed with bogs and swamps. The slight elevation above the sea-level of both these tracts must

have rendered the natural drainage very imperfect, and probably the rainfall would be much greater than at present.

With regard to the fauna, the animals would be much the same as at present, the beaver, the wolf, and the wild boar being probable additions, while most probably the red deer existed in considerable numbers.

The chief factors in the formation of the soil, as we now see it, have been (1) the clearance of wood and cultivation of the soil by man, (2) subaërial denudation and dissolution of the chalk by rainfall, (3) the action of earthworms. Before entering into historical matters, it will, perhaps, be as well to treat of the two latter factors. I do not think that subaërial denudation can have had much influence in our district during the comparatively short period we are considering. Until the slopes of the hills were cultivated their natural clothing of turf would protect them from the disintegrating influence of the frost, and in most cases from rain-washing, though on the clay and gravel soils this may well have had a greater influence. The amount of chalk dissolved by the carbonic acid in rain-water has been calculated at 9-100ths of an inch per century, and even if we suppose the rainfall to have been twice as great as at present, this would only amount to 2·7 in. in 2000 years.

In regard to earthworms, Darwin's well-known work on these animals, largely based on observations in a district adjoining and similar to ours, shows that they have played a very important part. One of his experiments showed that a layer of chalk spread on a meadow was buried to the depth of 7 in. in 29 years. He states that over 10 tons of dry earth annually passes through their bodies, and is brought to the surface on each acre of land, so that the whole superficial bed of vegetable mould passes through their bodies in the course of every few years. Their habit of dragging leaves into their burrows adds to the soil, and by the acids formed by their decay disintegrates the lower beds. The castings ejected are washed by the rain, blown by the wind, or spread by animals, until every irregularity is filled up. The well-known ledges on the slopes of the hills, generally called sheep-walks, are in all probability due to the worm-castings rolling down until stopped by some irregularity of the surface, plants, or grass. If these are carefully examined they will be found to taper off at each end to other ridges, more like long scales than definite paths. Although these tracks are used by sheep, Professor Henslow and Darwin do not consider that they are formed by them.

But the most important influence on the aspect of the land, as we now see it, has been man and his domestic animals. The early races of prehistoric man, being solely hunters and not cultivating the soil, would change it but little, but later races

have done much in this way. The first inhabitants of our district of whom we have any historical record are the Belgæ, who no doubt had dispossessed their kinsmen the Keltæ, the successors of an unknown number of agricultural races. At the invasion of Cæsar, Britain was the granary of Gaul. With the rude tools and imperfect husbandry of those times this must have argued that a considerable area of land was under cultivation, and this would have necessitated a very long period of clearances. The nearest parallel at the present day to the condition of England at that time is the state of things in Central Africa, that is, isolated villages in the primæval forest, each surrounded by a belt of cultivation, and communicating with the neighbouring villages by narrow footpaths through the forest.

The Roman invasion had little influence outside the large towns, and probably affected our district to a very small extent. They introduced, or have the credit of introducing, the elm and the pheasant, both of which are now conspicuous members of our flora and fauna. In agriculture their influence seems to have been nil, much as in India the native retains his ancient customs under the British Raj.

The coming of the various Teutonic races known as the Saxons was of great importance. This race entirely replaced the Keltic inhabitants, and no doubt made great alterations in the system of cultivation. Although it is very probable that the Kelts had some communal system of agriculture, the system which has had the greatest influence on our landscape, namely, the Three-field System, was practised by the Saxons in their continental homes, and applied here, so to speak, ready made. The Saxons also introduced the domestic ox of long-horn type, descended from the urus of Germany, a very distinct animal from the Keltic shorthorn, *Bos longifrons*. It is to this animal that we owe the present condition of our arable land, as, until comparatively recent times, the horse was not used for ploughing to any great extent, and even at the end of the last century an agricultural writer of Croydon advocates the use of oxen as more profitable. The three-field communal system was worked thus:—The houses of each village, with their gardens, orchards, &c., were grouped together, and the ring of arable land around them was divided into three great fields without hedges. Each of these fields was again divided into many long strips. The plough was a massive affair, constructed mainly of wood, and required no less than eight oxen to draw it. The long strips were divided from each other by "balks" of turf left unploughed. It does not appear very certain how many of these strips were ploughed in each year by one plough, but at any rate the strips were changed each year, so that all should have an equal share of good and bad land. It was usual for the normal team of eight oxen to be made

up from several different peasants, who shared the produce in proportion to the oxen. One field was in corn, the second in green fodder, and the third in fallow in each year. Outside the arable land were Lammas meadows (*i. e.*, meadows kept for hay, but grazed after hay harvest), common pasture, and common woodland. The cattle, geese, &c., also grazed on the fallow field. It is said that working oxen, in order to thrive, must have plenty of space and grazing after their work, and it is possible that their disuse is partly owing to the gradual enclosure of common land. It will be readily seen what an important factor these lumbering ploughs, working for a thousand years at least, must have been in the carving down of the surface of the land. Especially has this been so on the slopes of the chalk-hills, where it is customary to plough one way only, turning the sod downhill, the plough returning idle. This has the effect of moving the entire top soil of the field one furrow wide downhill at each ploughing. This custom would have ere now removed all the soil to the bottoms, but this was prevented by the other custom mentioned, that of ploughing in strips only. This resulted in the formation of what are called linces, a series of steps on the hill-side; this is not often seen now, owing to the linces, after the disuse of the communal system, being ploughed down; but there are some very fine examples on the chalk between Calais and Boulogne, where the French system of *petite* culture has preserved them. This ploughing of linces has been further extended with the object of enlarging the fields; very many linces have been ploughed in Coulsdon parish during the last ten years. After a while the upper part of the hill-side is all ploughed away, and has to go out of cultivation, on account of the chalk being left bare. Thus the slopes of the hills tend to go out of cultivation, and return to a condition of waste.

The first, and, indeed, the only complete record we have of the state of our district in ancient times is that remarkable survey known as Domesday Book, compiled about 1080 A.D. This survey was made for the purpose of taxation, and does not give exact quantities of land, &c., but only, so to speak, their rateable value. On examining the record for our district it is very remarkable how nearly, so far as we can judge, the amount of arable land, &c., approximates to what we now see. It is not always certain whether the boundaries of the Domesday manors were the same as those of the present parishes, but in many cases we have no reason to doubt that they were. The survey runs somewhat in this form :—The manor of so-and-so is held by A. B. of M. N.; in King Edward's time it was valued (or taxed) at so many hides, now so many; there is land for so many ploughs, and the woods yield so many swine. Other items adding to the value are also mentioned. The items of plough-lands and swine

give some idea of how much land was arable and woodland respectively.

From an examination of typical parishes in the Hundreds of Wallington and Tandridge, I have been able to get some rough approximation of the amount of land in arable, common, and wood. The plough-land is taken by most writers at 120 acres, more or less according to the soil, about an equal quantity of meadow and waste would be required for the grazing of the oxen, and to provide hay to keep them through the winter. This leaves about 25 acres of woodland for each hog yielded, which may have been every seventh or tenth hog, or some such proportion. If we work this out it comes very near the present acreage of the parishes, for example, Croydon :—

20 plough-lands at 120 a.	=2400 arable.
Equal waste	=2400 grazing land.
200 swine at 25 a.	=5000 woodland.
	9800, present area, 9901.

Coulsdon (two manors in Domesday) :—

18 plough-lands at 120 a.	=2160, arable in 1840,	2600
Equal waste	=2160, grazing land in 1840,	1575
9 swine at 25 a.	= 225, woodland in 1840,	200
	orchard and gardens,	28
	4545	4403

Beddington (two manors in Domesday) :—

12 plough-lands at 120 a.		=1440 arable.
	1	1440 grazing, &c.
10 swine at	25 a.	250
		3130, present, 3128.

Of course, other parishes do not all work out so well as these, but the general inference I draw is this, that the parishes on the chalk have not changed their aspect to any very material extent during these 800 years, especially if we allow for the many enclosures made during this century; while those of the forest belts north and south were at the time of Domesday but half cleared, and contained vast tracts of woodland. This is well shown in the case of the southern parishes by their peculiar shape.

These parishes each have their village on the fertile belt, and a long strip of woodland extending back to the Sussex forests, the four present parishes on the clay being not mentioned in Domesday, and created since. These manors yielded large

numbers of swine, second only to Croydon, with its Norwood of 5000 acres.

There is a similar looking series of parishes between Lewes and Keymer, in Sussex, but I do not know if their history is the same.

After Domesday we have but few records which give us much information. There are some which show that the head of the Wandle was formerly much higher than at present, the old town being intersected by a series of streams sufficient to furnish power to one or two mills. It would also appear that the Bourne of Caterham Valley was more frequent, and yielded more water than at present (if it is ever going to flow again).

I can find no direct evidence in our flora that the land was very much wetter, although it seems reasonable to suppose that the little *Sphagnum* bog on the Addington Hills is the last relic of a much more extensive one. There are some records of water plants on the chalk—at Coulsdon, for instance—which are not now found. I regard these as either referring to localities some distance away, such as Merstham, or isolated localities round ponds. There were formerly many more ponds than now, and it frequently happens that water plants are carried from one pond to another on the feet and feathers of aquatic birds.

There are many trees that now form an important element in our landscape that have been introduced by man. Fruit trees and shrubs, such as wild cherry, wild pear, currants, and gooseberries, are very old-established colonists, coming in probably in prehistoric times with their cultivators from Asia. The elm came with the Romans, the lime, sycamore, poplar, Scotch fir, larch, Spanish and horse-chestnut, some of which are important in our landscape, during historic times.

Corn-field weeds, though undoubtedly alien, are most likely as old as the corn they infest. Poppy, charlock, and mustard are conspicuous in our fields; the soil seems full of their seeds, and they can be of no recent introduction. The same applies to our long list of arable weeds. Beyond these there are scarcely any alien plants in our district of any importance.

With regard to the extinction of native plants by man, we have again no evidence to go on. It is probable that the orchids of our chalk-hills, now so rare, were more widely spread before the slopes were cultivated. There are two plants which have become extinct, or nearly so, in recent years in curious fashions. One is the common male fern, which was formerly in almost every wood, now scarcely to be found near London, the other the curious plant butcher's broom, *Ruscus aculeatus*. This was not uncommon on clay soils, but has been exterminated within a wide radius of London owing to it being used by tobacco manufacturers to dampen tobacco, the spines at the ends of the leaves (which

are not leaves at all, but flattened stems) throwing an even spray which cannot be produced by other means.

In respect to the fauna, and more especially the birds, I do not feel myself qualified to speak; perhaps some member better versed than myself can give us some information regarding their introduction or extinction.

There is one rather curious fact I have noticed, that is, that when a neighbourhood of villa residences has attained some age, and the trees and shrubs in the gardens are fairly grown, the number of species and individuals of birds and animals seems to be much greater than in a similar area of country. For example, in our garden at Kenley we have gained during the last ten years two species, the squirrel and the wood-pigeon; there are many more thrushes, black birds, and starlings, but we have lost the nightingales. No doubt there is greater protection from predatory wild animals, such as stoats, polecats, hawks, and owls, which counterbalances the risk of disturbance, besides possibly a better food supply than in the open.

In conclusion, I should be very pleased if these rambling notes could be supplemented by any information as to any known changes in our fauna during recent times, which I have no doubt some of our members will be able to give us.

91.—THE REPORT OF THE METEOROLOGICAL SUB-COMMITTEE FOR 1890.

PREPARED BY THE HON. SEC. F. C. BAYARD, F. R. Met. Soc.

(Read February 11th, 1891.)

THE arrangements for observing the daily rainfall round Croydon have been successfully carried out on the same plan as last year. The year commenced with a staff numbering 45 observers, superintending 53 stations, as against 38 observers and 45 stations in 1889, and 31 observers and 34 stations in 1888. No stations have been discontinued or moved during the year.

Appendix I. to this Report contains a list of the observers, with particulars relating to the stations and gauges. The stations with the asterisk prefixed were admitted after the commencement of the year, and the four with the double asterisk are stations which sent in reports in the previous year.

Appendix II. contains the tables of daily rainfall issued monthly, and subsequently stereotyped.

Appendix III. gives the monthly rainfall of the five other stations.

Appendix IV. gives a record of all falls of rain of 1 inch and upwards in the 24 hours, extracted from Appendix II.

And, finally, Appendix V. contains general notes on the characteristic features of every month.

The method of grouping the stations into districts adopted by the Sub-Committee seems on the whole to have given satisfaction. The Sub-Committee welcome the accession of South Norwood, and of one other station on the high ground at Banstead. The Sub-Committee much regret the absence of stations, with daily records, at Botley Hill, Betsom Hill, Knockholt, and Erith.

With reference to the rainfall of the year, if we take as a basis for comparison, the records of the stations in the districts for which we can obtain an average of ten years and over, it would seem to have been very deficient. The deficiency varies from 5 in. at Surbiton on a 35 years' average to 1·5 in. at Sutton on a 10 years' average. This reveals a somewhat serious state of things, for, combined with the deficiency of 1889, the amount of rain that has fallen over the district in the last two years is probably at least 3 in. less than the average amount over a long series of years. This want of rain, unless the spring and summer should turn out to be very wet, appears likely to cause a great deficiency in the water supply of the district, and the Sub-Committee cannot impress too strongly on the water authorities

the need that there is for the greatest economy in this all-important necessary of life. From the address of Mr. Baldwin Latham, President of the Royal Meteorological Society, delivered before the Society on Nov. 15th, 1890, we conclusively learn that all low-water years, that is, years in which the underground waters are low, are very unhealthy; and the reason is not far to seek, if we consider the different strata as shallow basins in which the impurities sink to the bottom, and are pumped up when the water is low. In this town of Croydon we have, thanks to the foresight of the Corporation, a supply of water which, though perhaps not quite as plentiful as it might be, is yet on the whole a fairly good one, and in quantity is far in excess of many of the villages and towns of the district. In giving utterance to these weighty words the Sub-Committee have no wish to create alarm, but it particularly desires to give warning as to a possible scarcity; and, in view of this, it trusts that every sanitary authority will do its very utmost to keep all streams and springs unpolluted.

Further, the Sub-Committee would draw attention to the very small number of days—only three—on which an inch and upwards fall in the 24 hours. The largest amount, 2·62 in., fell at Kingston, and the next largest, 2·47 in., at West Norwood in the 24 hours. The Sub-Committee express a hope that some day some one who has a self-recording gauge in Croydon will have a big fall of rain, so as to test our pipes in Croydon, and see whether they are prepared for it. If so, all honour to those who have so successfully planned and carried out the drainage of this great town.

In conclusion, the Sub-Committee ventures to ask the aid of every member of the Club in helping forward, both financially and otherwise, its observational labours, as being intimately connected with the health and happiness of us all.

APPENDIX I.

No.	Stations.	Observers.	Size of Gauge.	Height of Gauge above Ground.		Height of Gauge above Sea-level.
	Surrey—		In.	Ft.	In.	Ft.
	Dorking (Denbies)	J. Beesley	5	0	6	610
	Reigate Hill (Lovelands)	R. Binns	5	1	3	600
	Caterham (Metropolitan Asylum)	G. S. Elliott, M.D.	5	1	0	610
	Kent—					
	**Knockholt (The Beeches)	W. Morris, C.E.	5	1	0	785
	Surrey—					
5	Marden Park (Birchwood House)	C. & F. Rutley	5	1	0	471
	Kenley (Ingleside)	Harold Smith	8	1	0	375
	Purley (Reedham Asylum)	J. A. Carter	5	1	0	375
	Purley (Tudor Cottages)	J. Bonwick	5	1	0	216
	Ashtead (D'Abernon Chase)	Sir W. Vincent, Bart.	5	1	0	300
10	Sutton (Mulgrave Road)	W. Goode	5	5	6	230
	**Sutton (Grange Road)	W. Thurtell	5	1	6	230
	Carshalton (The Wrythe)	J. W. Manley	5	4	10	107
	Wallington (Manor Road)	F. C. Bayard	5	4	1	157
	Beddington (Riverside)	S. Rostron	5	1	0	120
15	Waddon (Waddon House)	P. Crowley	5	1	0	156
	Croydon (Brimstone Barn)	Croydon Corporation	5	1	0	130
	Croydon (Limes Road)	Croydon Corporation	5	1	0	195
	Croydon (Whitgift)	A. E. Watson	5	1	0	191
	Addiscombe (Havelock Road)	Baldwin Latham, C.E.	8	1	0	205
20	Addiscombe (Outram Road)	E. Mawley	8	0	9	202
	Addington Hills (The Reservoir)	Croydon Corporation	8	0	9	473
	Addington (Park Farm)	W. Whalley	5	1	0	268
	Addington (Pumping Station)	Croydon Corporation	8	1	0	331
	Kent—					
	West Wickham (Layham's Farm)	W. Ashcroft	5	1	0	500
25	Hayes Common (The Warren)	Miss Akers	5	1	0	296
	Keston (Bradfield)	A. Hill	5	1	0	350
	Keston (Heathfield)	Miss M. Holland	5	0	6	420
	Keston (Tower Fields)	G. Buchanan, C.E.	8	0	9	351
	Orpington (Kent Waterworks)	W. Morris, C.E.	5	1	0	220
30	Farningham Hill	A. J. Waring	5	3	0	300
	Wilmington (Kent Waterworks)	W. Morris, C.E.	5	1	0	25
	Chislehurst (The Chestnuts)	J. B. Snell	5	1	0	325
	Bickley (Highfield)	J. Batten	5	1	2	295
	Beckenham (Foxgrove)	P. Bicknell	5	0	6	142
	Surrey—					
35	*South Norwood (Whitworth Road)	H. F. Parsons, M.D.	5	1	2	200
	Wimbledon (Sewerage Works)	C. H. Cooper, C.E.	5	1	0	58
	Wimbledon (Mount Ararat)	T. Devas	12	3	0	157
	Raynes Park (Pumping Station)	C. H. Cooper, C.E.	5	1	0	47
	New Malden (Sewerage Works)	T. L. Heward	5	1	0	45
40	**Esher (West End)	W. H. Dines	5	1	0	51
	Esher (Sewerage Works)	Baldwin Latham, C.E.	5	1	0	40
	Surbiton (Seething Wells)	R. Hack, C.E.	10	0	6	25
	Kingston (Sewerage Works)	T. Stevens	5	1	0	25
	Richmond (Ormond Lodge)	J. T. Billett	5	0	9	51
45	Kew (Kew Observatory)	The Kew Committee	11	1	9	19
	Brixton (Acre Lane)	F. Gaster	8	1	0	77
	West Norwood (Thornlaw Road)	W. Marriott	8	1	0	220
	Kent—					
	Sydenham (Longton Grove)	M. J. Porter	8	4	6	220
	Forest Hill (Dartmouth Road)	Mrs. Behrens	5	1	0	220
50	Deptford (Kent Waterworks)	W. Morris, C.E.	5	1	0	20
	Greenwich (The Royal Observatory)	The Astronomer Royal	8	0	5	155
	**Woolwich (Shooter's Hill)	Capt. S. D. Cleeve, R.E.	5	1	0	352
	Eltham (Victoria Road)	Capt. M. S. Richardson, R.E.	5	1	0	205

APPENDIX II.

Daily Rainfall. **January, 1890.**

Day of Month	Dorking	ReigateHill	Caterham	Marden Park	Kenley	Purley (Reedham)	Purley (Tudor C.)	Ashtead	Sutton	Carshalton	Wallington	Bedding-ton	Waddon	Croydon (Brim. Bn.)	Croydon (Limes Rd.)	Croydon (Whitgift)	Addiscmb. (Hvlk. Rd.)	Addiscmb. (Outm. Rd.)	Addington Hills	Addington (Park Fm.)	Addington (Pump. St.)	West Wickham	Hayes Common	Keston (Bradfield)
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	·03	..	..	..	..	..	·01	..
2	..	..	..	·01	·01	..	..	..	..	..	..	·01	..	..	·01	..	..	..	..	..	..	..	..	..
3	·20	·09	·11	·05	·06	·07	·08	..	·15	·09	·09	·06	·05	..	·05	·04	·05	·03	·06	·05	·03	·06	·09	·08
4	·25	·32	·38	·31	·17	·22	·23	·20	·16	·20	·18	·15	·19	·12	·25	·31	·17	·19	·20	·11	·16	·19	·16	·11
5	·29	·28	·25	·24	·44	·24	·33	·25	·18	·15	·23	·25	·18	·20	·17	·12	·24	·28	·27	·45	·36	·34	·38	·32
6	·20	·30	·25	·20	·24	·14	·16	·21	·06	·04	·08	·08	·07	·04	·04	·08	·09	·10	·12	·15	·16	·20	·11	·09
7	..	·01	..	·01	·01	·01	·02	..	..	..	·01	..	·01	..	·01	..	..	..	..	..	..	..	..	..
8	·05	·02	·02	..	·02	..	·02	..	·03	..	·04	·04	·02	·03	·02	..	·02	·01	..	..	..	..	..	..
9	·20	·24	·24	·22	·21	·15	·16	·18	·12	·12	·13	·13	·11	·06	·13	·16	·13	·14	·14	·15	·17	·16	·15	·10
10	..	..	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
11	·02	·02	·02	·01	·01	·01	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	·01	·02	·01
12	..	..	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
13	·02	·02	..	..	·02	·01	·01	..	..	..	·01	..	..	..	..	·01	..	·01	·01	..	·01	·01	..	·01
14	..	·03	..	·02	·01	..	·02	..	..	..	..	..	..	..	..	·01	..	..	·02	..	·01	·01	..	·01
15	·05	·06	·05	·02	·03	·01	·01	..	·01	·01	·01	·01	·01	..	..	·01	·02	·01	..	..	·01	·02	..	..
16	..	..	·03	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	..	..	..
17	·22	·15	·17	·19	·22	·19	·23	·23	·19	·19	·20	·20	·19	·15	·20	·21	·21	·20	·20	·20	·20	·20	·20	·17
18	·36	·38	·38	·29	·25	·15	·20	·18	·12	·14	·14	·13	·12	·06	·18	·12	·13	·13	·20	·23	·20	·27	·20	·14
19	..	..	..	..	·02	·02	·01	·07	·13	·12	·10	·12	·08	·11	·11	·08	·08	·10	·06	·03	·02	·01	·03	·04
20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	..	..	..
21	·29	·19	·17	·20	·21	·16	·16	·28	·17	·15	·18	·17	·15	·15	·14	·16	·15	·14	·16	·14	·14	·17	·12	·12
22	·32	·32	·40	·43	·29	·28	·35	·37	·33	·30	·28	·28	·29	·25	·30	·27	·45	·46	·37	·23	·28	·28	·29	·24
23	·12	·16	·10	·13	·24	·15	·09	·10	·07	·04	·20	·15	·18	·11	·06	·18	·03	·03	·13	·18	·17	·21	·20	·16
24	·15	·16	·18	·18	·11	·09	·10	·11	·10	·05	·07	·06	·06	·05	·05	·07	·07	·07	·09	·09	·08	·08	·09	·07
25	·15	·16	..	·10	·16	·09	·11	·07	·07	·04	·07	·05	·05	·04	·06	·07	·08	·10	·10	·04	·15	·16	·11	·08
26	·13	·03	·07	·07	·04	·05	·06	·08	·07	·03	·05	·04	·04	·03	·04	·06	·06	·05	·06	·05	·08	·06	·04	·03
27	·25	·21	·40	·38	·16	·16	·15	·24	·24	·23	·16	·15	·14	..	·25	·15	·23	·18	·13	·11	·13	·14	·10	·15
28	·35	·33	·20	·16	·27	·20	·21	·21	·15	·11	·20	·19	·18	·16	·12	·21	·12	·19	·19	·26	·22	·30	·20	·21
29	·03	·04	·05	·05	·06	·05	·05	·07	·04	·04	·04	·05	·05	·05	·05	·06	·06	·06	·07	·06	·06	·06	·07	·07
30	·07	·11	·15	·11	·11	·11	·03	·06	·06	·05	·07	·08	·08	·08	·09	·09	·10	·09	·10	·12	·11	·13	·12	·13
31	·04	·06	·07	·08	·08	·07	·16	..	·06	·04	·06	·05	·05	·05	·05	·05	·06	·06	·08	·07	·05	·07	·07	·07
Total	3·76	3·69	3·69	3·46	3·46	2·63	2·97	2·91	2·51	2·14	2·60	2·45	2·30	1·74	2·38	2·55	2·58	2·63	2·76	2·72	2·80	3·14	2·76	2·41
From Jan. 1	3·76	3·69	3·69	3·46	3·46	2·63	2·97	2·91	2·51	2·14	2·60	2·45	2·30	1·74	2·38	2·55	2·58	2·63	2·76	2·72	2·80	3·14	2·76	2·41

Day of Month	Keston (Heathfld.)	Keston (Tow. Fds.)	Orpington	Farningham Hill	Wilmington	Chislehurst	Bickley	Beckenham	Wimbledon (Sew. Wks.)	Wimbledon (Mt. Ararat)	Raynes Park	New Malden	Esher	Surbiton	Kingston	Richmond	Kew	Brixton	West Norwood	Sydenham	Forest Hill	Deptford	Greenwich	Eltham
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	..	..	..	..	..	..	·01	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	..	..
2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
3	·09	·11	·02	·02	·06	·04	·10	·08	·07	·13	·13	·15	·17	·20	·18	·16	·18	·14	·06	·15	·06	·05	·06	·07
4	·18	·15	·10	·04	·22	·15	·05	·14	·13	·23	·14	·12	·20	·17	·25	·25	·19	·14	·11	·20	·24	·23	·12	·06
5	·41	·43	·33	·36	·07	·24	·37	·19	·09	·03	·14	·11	·11	·15	·12	·12	·12	·12	·10	·09	·06	·01	·08	·21
6	·16	·15	·14	·10	·03	·06	·06	·05	·16	·06	·08	·05	·03	·10	·08	·08	·06	·09	·03	·03	..	·01	·04	·03
7	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	·01	·01
8	·01	..	..	..	..	..	·02	·01	·07	·08	·05	·05	·05	·05	·07	·15	·14	·06	·01	..	·02	·02	·02	·04
9	·17	·18	·13	·13	·09	·11	·12	·11	·13	·13	·14	·10	·04	·11	·14	·16	·15	·15	·13	·01	·11	·14	·14	·09
10	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
11	·02	·01	..	..	..	·02	·01	·02	·01	·01	·02	..	·03	·01	..	·02	·01	..	·01	..	·01	..	·01	·02
12	..	..	..	·01	..	..	·02	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..
13	·01	·01	..	·01	..	·01	..	..	·01	·01	·01	..	·03	..	..	·02	·01	·01	·01	..	..	..	..	..
14	·02	..	..	..	..	·01	..	..	..	..	..	..	·04	..	..	..	..	..	..	..	..	..	..	·01
15	..	·01	·01	..	..	..	·02	·01	..	..	..	..	..	..	·01	..	..	..	..	..	..	..	..	·01
16	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
17	·23	·23	·19	·18	·15	·15	·18	·17	·12	·05	·15	·12	..	·15	·18	·13	·12	·13	·14	·16	·13	·13	·13	·13
18	·21	·20	·20	·15	·20	·14	·11	·11	..	·20	·18	·15	·17	·14	·27	·16	·14	·19	·14	·24	·21	·17	·23	·13
19	·04	·07	·02	·04	·04	·11	·10	·14	·13	·08	·10	·08	..	·05	·03	·07	·06	·16	·12	·04	·04	·15	·09	·11
20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	·01	..	..	..	..	..	..	..
21	·14	·13	·12	·10	·09	·22	·11	·12	·21	·23	·24	·21	·10	·29	·24	·13	·11	·23	·16	·15	·13	·18	·17	·11
22	·26	·25	·27	·21	·36	·04	·45	·21	·10	..	·12	·11	·05	·12	·12	·12	·11	·14	·17	·21	·14	·15	·15	·22
23	·19	·19	·15	·17	·05	·31	·07	·16	·08	·16	·09	·05	·33	·03	·03	..	·01	·02	·04	·06	·08	·06	·07	·13
24	·09	·09	·08	·07	·06	·08	·08	·07	·06	..	·06	·05	·01	·06	·06	·07	·06	·08	·06	·09	·06	·05	·06	·06
25	·13	·13	·10	·05	..	·06	·06	·04	·03	·02	·02	·02	·05	·02	·02	·06	·06	·03	·01	·09	·08	·01	·01	·04
26	·10	·04	·03	·03	·04	·03	·04	·05	·06	·04	·05	·02	·02	·05	·05	·09	·09	·05	·05	·06	·07	·06	·06	·07
27	·12	·17	·15	·15	·25	·18	·27	·17	·20	·20	·20	·19	..	·22	·23	·32	·36	·15	·21	·29	·24	·25	·28	·28
28	·23	·22	·21	·18	·16	·23	·19	·23	·19	·20	·22	·17	·33	·18	·21	·18	·12	·27	·20	·23	·19	·23	·24	·21
29	·08	·08	·07	·05	·05	·07	·07	·06	·04	·04	·04	·03	·04	·01	·02	·02	·02	·05	·05	·05	·05	·04	·05	·07
30	·12	·12	·11	·13	·12	·08	·10	·09	·04	·05	·05	·03	·02	·02	·02	·03	·02	·03	·06	·13	·15	·05	·06	·08
31	·06	·06	·06	·05	·06	·05	·05	·06	·03	·03	·03	·02	·01	·02	·01	·02	·01	·02	·04	·05	·02	·02	·03	·06
Total	3·08	3·03	2·49	2·23	2·10	2·39	2·65	2·30	1·96	1·98	2·27	1·83	1·83	2·15	2·34	2·37	2·17	2·26	1·91	2·34	2·09	2·01	2·11	2·25
From Jan. 1	3·08	3·03	2·49	2.23	2·10	2·39	2·65	2·30	1·96	1·98	2·27	1·83	1·83	2·15	2·34	2·37	2·17	2·26	1·91	2·34	2·09	2·01	2·11	2·25

Day of Month	Dorking	Reigate Hill	Caterham	Marden Park	Kenley	Purley (Reedham)	Purley (Tudor C.)	Ashtead	Sutton	Carshalton	Wallington	Bedding-ton
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	·02	·03	·01	·01	..	·01	..	..	·01	..	..
2	..	..	..	..	..	·01	·01	..	..	..	..	·01
3	..	..	..	..	..	..	..	..	..	..	..	..
4	..	·03	..	..	·03	..	·03	..	·03	·02	·02	·02
5	·04	·03	..	·09	·01	·07	·05	·12	·02	·02	·03	·03
6	..	..	..	..	..	..	..	..	..	·01	·01	·01
7	..	..	..	·01	..	..	..	..	..	..	..	..
8	..	..	..	..	..	..	..	..	..	..	..	..
9	..	..	..	..	..	..	..	..	..	..	..	..
10	..	..	..	·01	..	..	..	..	..	..	..	..
11	..	..	..	..	..	..	..	..	..	..	..	..
12	..	..	..	..	..	..	..	..	..	..	..	..
13	..	·02	·09	·03	..	·05	·03	..	·07	·05	·05	·05
14	·20	·52	..	·46	·49	·60	·56	·65	·58	·64	·57	·60
15	·54	·58	·80	·30	·24	·20	·25	·23	·27	·15	·22	·20
16	..	·01	..	..	·01	·01	·03	..	..	..	..	..
17	..	..	..	·01	..	..	..	..	..	..	..	..
18	..	..	..	..	..	..	..	..	..	..	..	..
19	..	..	..	..	..	..	..	·04	..	..	·01	..
20	·02	·04	..	·03	·03	·04	·05	·03	·03	·02	·03	·04
21	..	..	..	..	·01	..	..	..	..	·01	..	..
22	..	..	·04	..	..	..	..	..	..	..	..	..
23	..	..	..	..	..	..	..	..	..	..	..	..
24	..	..	..	..	..	..	..	..	..	..	..	..
25	..	..	..	..	..	..	..	..	..	..	..	..
26	..	·02	·03	·02	·02	·04	·03	·03	·03	·02	·02	·02
27	..	·01	..	·02	·01	·01	·01	..	..	·02	·03	·01
28	..	..	..	..	..	..	..	..	..	..	..	..
Total	·30	1·28	·99	·99	·86	1·03	1·06	1·10	1·03	·97	·99	·99
From Jan. 1	4·56	4·97	4·68	4·45	4·32	3·66	4·03	4·01	3·54	3·11	3·59	3·44

Day of Month	Waddon	Croydon (Brim. Bn.)	Croydon (Limes Rd.)	Croydon (Whitgift)	Addiscmb. (Hvlk. Rd.)	Addiscmb. (Outm. Rd.)	Addington Hills	Addington (Park Fm.)	Addington (Pump. St.)	West Wickham	Hayes Common	Keston (Bradfield)
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	..	·01	..	..	..	..	·01	..	·01	..	..
2	..	..	..	..	..	..	..	·01	..	..	..	..
3	..	..	..	..	..	..	..	..	..	..	..	..
4	·02	..	·03	·03	·03	·02	·02	..	·03	·02	·02	·02
5	·03	..	·01	·03	·03	·03	·03	·05	·04	·05	·01	·04
6	·01	..	..	·01	..	·01	..	..	..	·01	·01	·01
7	..	..	..	..	..	..	..	..	..	..	..	..
8	..	..	..	..	..	..	..	..	..	..	..	..
9	..	..	..	..	..	..	..	..	..	..	..	..
10	..	..	..	..	..	..	..	..	..	..	..	..
11	..	..	..	..	..	..	..	..	..	..	..	..
12	..	..	..	..	..	..	..	..	·01	..	·01	..
13	·04	..	·03	·05	[illegible]	·04	[illegible]	..	·02	·03	·04	·04
14	·57	·52	·63	·60	·51	·55	[illegible]	[illegible]	·54	·51	·55	·53
15	·20	·18	·12	·25	·21	·19	[illegible]	·54	·20	[illegible]	·24	·19
16	..	..	..	·01	..	..	..	..	·01	·02	·02	·02
17	..	..	..	..	..	..	..	..	..	..	·01	..
18	..	..	..	..	..	..	..	..	..	..	..	..
19	..	..	..	..	..	..	..	..	..	..	..	..
20	·04	·03	·02	·04	·05	·04	·04	·02	·03	·03	·03	·03
21	..	..	..	..	..	..	..	..	..	..	..	..
22	..	..	..	..	..	..	..	..	..	..	..	..
23	..	..	..	..	..	..	..	..	..	..	..	..
24	..	..	..	..	..	..	..	..	..	..	..	..
25	..	..	..	..	..	..	..	..	..	..	·01	..
26	..	·01	·01	·02	·03	·02	·01	..	·01	·02	..	·03
27	..	..	·01	·02	·01	·01	..	..	·01	..	·01	·01
28	..	·01	..	..	..	..	..	..	..	..	..	..
Total	·91	·75	·87	1·07	·93	·92	·79	·73	·90	·94	·99	·97
From Jan. 1	3·21	2·49	3·25	3·62	3·51	3·55	3·55	3·45	3·70	4·08	3·75	3·38

Day of Month	Keston (Heathfd.)	Keston (Tow. Fds.)	Orpington	Farning-ham Hill	Wilming-ton	Chislehurst	Bickley	Beckenham	Wimbledon (Sew. Wks.)	Wimbledon (Mt. Ararat)	Raynes Park	New Malden
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	..	..	·02	..	..	·02	·01	·01	·01	·02	..
2	·01	..	..	·01	..	·01	..	..	..	·01	·01	..
3	·03	..	..	..	..	..	..	..	..	..	..	..
4	..	·02	..	·04	·03	·02	·02	·01	·01	·03	·02	·02
5	·05	·05	·07	·05	·03	·02	·04	·02	·03	·03	·04	·02
6	·01	..	..	..	·01	..	..	..	·01	..	·01	..
7	..	..	..	..	..	..	..	..	..	..	..	..
8	..	..	..	..	..	..	..	..	..	..	..	..
9	..	..	..	..	..	..	..	..	..	..	..	..
10	..	..	..	..	..	..	..	..	..	..	..	..
11	..	..	..	·01	..	..	..	..	..	..	..	..
12	..	..	..	..	..	..	..	..	..	..	·01	..
13	·07	·07	..	·02	·04	·07	·05	·06	·08	..	·05	..
14	·58	·51	·51	·54	·63	·47	·65	·50	·65	·68	·53	·49
15	·20	·21	·33	·15	·18	·26	·21	·20	·26	·33	·24	·12
16	·02	·02	·02	·01	·02	·01	..	..	..	..	..	..
17	..	..	..	..	..	..	..	..	..	..	..	..
18	..	·01	..	·01	..	..	..	..	..	..	..	..
19	..	..	..	..	..	..	..	..	..	..	..	..
20	·04	·04	·02	·05	·05	..	·04	·05	·02	..	·02	..
21	·01	..	..	..	..	..	..	..	..	..	..	..
22	..	..	..	..	..	..	..	..	..	..	..	..
23	·01	..	..	·01	..	..	..	..	..	..	..	..
24	..	..	..	..	..	..	..	..	..	..	..	..
25	..	..	..	..	..	..	..	..	..	·01	..	..
26	·03	·01	..	·03	·02	·02	·01	·01	..	..	·02	..
27	·01	..	..	·01	·01	..	·01	..	·02	..	..	..
28	..	·01	..	..	..	..	..	..	..	..	..	..
Total	1·07	·95	·95	·96	1·02	·88	1·05	·86	1·09	1·10	·97	·65
From Jan. 1	4·15	3·98	3·44	3.19	3·12	3·27	3·70	3·16	3·05	3·08	3·24	2·48

Day of Month	Esher	Surbiton	Kingston	Richmond	Kew	Brixton	West Norwood	Sydenham	Forest Hill	Deptford	Greenwich	Eltham
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	·01	·01	·01	..	·01	·01	..	·02	·02	·02	·02
2	·01	·01	..	..	·01	..	..	..	..	..	..	..
3	..	..	..	..	..	..	..	..	..	..	..	..
4	·04	..	·02	·01	·01	..	..	..	·02	..	..	·02
5	..	·04	·04	·03	·01	..	·05	·07	..	·04	·04	·05
6	..	..	..	..	..	·03	..	..	..	..	..	..
7	..	..	..	..	..	..	..	..	..	..	..	..
8	..	..	..	..	..	..	..	..	..	..	..	..
9	..	..	..	..	..	..	..	..	..	..	..	..
10	..	..	..	..	·01	..	..	..	..	..	..	..
11	..	..	..	..	..	..	..	..	..	..	..	..
12	..	..	..	..	..	..	..	..	..	..	..	..
13	·02	·02	·02	·02	·02	·04	·03	·08	·11	·03	·02	·03
14	·53	·55	·64	·58	·62	·54	·57	·60	·41	·60	·59	·57
15	·17	·20	·22	·28	·19	·35	·23	·34	·39	·23	·26	·13
16	..	..	..	..	..	..	..	..	..	..	..	·01
17	..	..	..	..	..	..	..	..	..	..	..	..
18	..	..	..	..	..	..	..	..	..	..	..	..
19	·02	..	..	..	..	..	..	..	..	..	..	..
20	·02	·02	·01	·02	·01	..	·02	·04	..	·02	·04	·05
21	·01	..	..	..	..	..	..	..	..	..	..	..
22	..	..	..	..	..	..	..	..	..	..	..	..
23	..	..	..	..	..	..	..	..	..	..	..	..
24	..	..	..	..	..	..	..	..	..	..	..	..
25	..	..	..	..	..	·01	..	·01	..	..	..	..
26	..	..	·01	..	·01	..	·02	·02	..	·01	·03	·01
27	..	·01	..	·01	·01	·02	·01	..	..	..	·01	·02
28	..	..	..	..	..	..	..	·01	·03	..	..	..
Total	·82	·86	·97	·96	·90	1·00	·99	1·17	·98	·95	1·01	·91
From Jan. 1	2·65	3·01	3·31	3·33	3·07	3·26	2·90	3·51	3·07	2·96	3·12	3·16

Daily Rainfall. **March, 1890.**

Day of Month	Dorking	ReigateHill	Caterham	Marden Park	Kenley	Purley (Reedham)	Purley (Tudor C.)	Ashtead	Sutton	Carshalton	Wallington	Bedding-ton
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·22	·30	·30	·24	·25	·35	·28	·17	·18	·19	·26	·24
2	·06	·10	..	·13	·03	·07	·15	·08	·12	·09	·06	·06
3	..	..	..	..	..	..	..	..	..	..	..	..
4	·02	..	..	..	..	·03	·05	·05	·03	·02	·03	·04
5	..	·09	·17	..	·05	..	·06	..	..	..	..	..
6	..	..	·02	·05	·03	·01	·02	·03	..	..	·01	·01
7	..	·01	·02	·02	·02	·01	·01	..	..	..	..	..
8	·27	·18	·21	·19	·30	·27	·21	·20	·17	·15	·18	·18
9	·14	·14	·19	·24	·12	·10	·11	·17	·14	·20	·11	·10
10	·16	·09	·12	·03	·09	·11	·15	·07	·10	..	·12	·11
11	..	..	..	..	..	..	·01	..	..	..	..	..
12	..	..	..	..	..	..	..	..	..	..	..	..
13	..	..	..	..	..	..	..	..	..	..	..	..
14	..	..	..	..	..	..	..	·03	..	..	..	..
15	·06	..	..	..	..	..	..	·04	..	·03	..	..
16	·09	·06	·01	·01	·01	·01	..	·15	·05	·03	·03	·02
17	..	..	..	..	..	..	·01	..	..	..	..	..
18	·15	·07	·10	·08	·06	·08	·10	·07	·08	·07	·08	·08
19	·55	1·01	·80	·59	·65	·74	·67	·45	·45	·52	·57	·56
20	·11	·13	·12	·07	·12	·11	·20	·12	·08	·08	·10	·09
21	·05	·07	·10	·08	·07	·05	·06	·14	·07	·06	·06	·05
22	·02	·09	..	·06	·06	·05	·03	·04	..	·01	·02	·02
23	·25	·20	·12	·30	·16	·12	·23	·18	·15	·11	·19	·20
24	·60	·52	·77	·48	·57	·54	·54	·44	·44	·42	·46	·41
25	·04	·04	·04	·04	·02	·02	·05	·05	·03	·01	·03	·02
26	..	..	..	..	..	..	·01	..	..	..	..	..
27	..	..	..	..	..	..	..	..	..	..	..	..
28	..	..	..	..	..	..	..	..	..	..	..	..
29	..	..	..	..	..	..	..	..	..	..	..	..
30	..	..	..	..	..	..	..	..	..	..	..	..
31	..	..	..	..	..	..	..	..	..	..	..	..
Total	2·79	3·10	3·00	2·61	2·61	2·67	2·95	2·48	2·09	1·99	2·31	2·19
From Jan. 1	7·35	8·07	7·77	7·29	6·93	6·33	6·98	6·49	5·63	5·10	5·90	5·63

Day of Month	Waddon	Croydon (Brim. Bn.)	Croydon (Limes Rd.)	Croydon (Whitgift)	Addiscomb. (Hvlk. Rd.)	Addiscomb. (Outm. Rd.)	Addington Hills	Addington (Park Fm.)	Addington (Pump. St.)	West Wickham	Hayes Common	Keston (Bradfield)
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·23	·30	·35	·35	·35	·36	·41	·37	·30	·33	·20	·34
2	·06	·05	·05	·05	·08	·08	·05	·08	·05	·06	·08	·13
3	..	..	..	..	..	..	..	..	·01	..	..	·01
4	·03	·03	·02	·03	..	·03	·03	·03	·02	·06	·04	·03
5	..	..	..	..	..	..	..	..	..	..	..	..
6	..	·02	..	·01	..	..	·02	..	·02	..	..	..
7	·01	..	·01	·01	·05	·01	·01	..	·01	·01	·01	·01
8	·18	·16	·19	·19	·17	·17	·19	·18	·21	·25	·17	·16
9	·11	·08	·21	·08	·14	·13	·08	·10	·06	·08	·08	·07
10	·10	·09	·01	·12	·08	·09	·12	..	·09	·13	·12	·08
11	..	..	..	..	..	..	..	..	..	..	·01	..
12	..	..	..	..	..	..	..	..	..	..	..	..
13	..	..	..	..	..	..	..	..	..	..	..	..
14	..	..	..	..	..	..	..	..	..	..	..	..
15	..	..	..	..	..	·01	..	..	..	..	..	..
16	·01	·01	..	·01	..	..	..	·01	·01	..	..	·02
17	..	..	..	..	..	..	..	..	..	..	..	..
18	·08	·07	·08	·08	·08	·09	·11	·03	·11	·14	·11	·12
19	·58	·40	·62	·61	·69	·66	·66	·78	·84	·56	·78	·81
20	·10	·06	·06	·10	·15	·10	·12	·07	·15	·24	·12	·18
21	·06	·06	·06	·06	·07	·06	·06	..	·06	·07	·06	·05
22	·01	..	..	·01	..	·01	·02	·03	·02	·03	·01	·02
23	·20	·18	·13	·24	·17	·15	·12	·12	·13	·18	·12	·12
24	·37	·38	·37	·41	·38	·36	·45	·46	·45	·42	·41	·34
25	·02	·03	·01	·02	·02	·02	·06	·04	·03	·02	·05	·05
26	..	..	..	..	..	..	..	..	..	..	·01	..
27	..	..	..	..	..	..	..	..	..	..	..	..
28	..	..	..	..	..	..	..	..	..	..	..	..
29	..	..	..	..	..	..	..	..	..	..	..	..
30	..	..	..	..	..	..	..	..	..	..	..	..
31	..	..	..	..	..	..	..	..	..	..	..	..
Total	2·15	1·92	2·17	2·38	2·43	2·33	2·51	2·30	2·57	2·58	2·38	2·54
From Jan. 1	5·36	4·41	5·42	6·00	5·94	5·88	6·06	5·75	6·27	6·66	6·13	5·92

Day of Month	Keston (Heathfld.)	Keston (Tow. Fds.)	Orpington	Farningham Hill	Wilmington	Chislehurst	Bickley	Beckenham	Wimbledon (Sew. Wks.)	Wimbledon (Mt. Ararat)	Raynes Park	New Malden	Esher	Surbiton	Kingston	Richmond	Kew	Brixton	West Norwood	Sydenham	Forest Hill	Deptford	Greenwich	Eltham
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·40	·33	·25	·29	·23	·27	·60	·25	·22	·16	·20	..	..	·12	·16	·17	·16	·30	·21	·30	·28	·20	·20	·38
2	·15	·19	·15	·22	·08	·05	·11	·02	·03	·02	·02	·09	..	·02	·01	·01	·01	·02	·06	·05	·02	·01	·02	·07
3	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01
4	·04	..	·02	·04	·04	·05	·04	·02	·02	·03	·03	..	..	·01	·02	·02	·01	·02	·02	·02	·01	·02	·04	..
5	..	..	..	..	·01	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
6	..	·04	·01	·01	..	·02	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	..
7	·02	·05	..	·01	·01	·04	·03	·01	·02	·02	·02	..	·02	..	·01	·02	·03	..	·02	..	·02	·03	·04	·04
8	·19	·19	·17	·17	·16	·22	·23	·19	·18	·16	·14	·10	·04	·16	·19	·10	·08	·26	·20	·18	·19	·20	·21	·25
9	·10	·05	·07	·05	·11	·10	·19	·13	·14	·07	·13	·12	·25	·15	·19	·17	·20	·09	·18	·22	·05	·13	·13	·12
10	·09	·14	·13	·08	·04	·13	·09	·11	·11	·15	·11	·07	·03	·04	·03	·07	·01	·19	·08	·07	·21	·13	·11	·13
11	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	·01	..	..	..	..	..	..	..
12	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
13	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
14	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
15	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
16	·02	·02	..	·01	..	·01	..	..	·03	·04	·05	·03	..	·11	·08	·10	·08	·01	..	..	·01	..	..	·01
17	·01	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..
18	·12	·12	·10	·19	·18	·13	·17	·12	·08	·08	·06	·04	·01	·03	·06	·07	·06	·10	·11	·12	·22	·13	·16	·20
19	·78	·77	·99	1·10	·95	·77	·78	·70	·43	·36	·38	·32	·20	·36	·37	·34	·37	·44	·52	·58	·40	·54	·54	·73
20	·12	·20	·15	·15	·15	·13	·10	·11	·09	·08	·08	·06	·07	·05	·03	·07	·05	·10	·09	·10	·04	·07	·08	·09
21	·05	·03	·04	·02	·02	·03	·04	·05	·05	·06	·05	·04	..	·04	·04	·04	·03	·05	·05	·06	..	..	·02	·03
22	·04	·01	·01	..	·02	·01	·01	·01	·02	·02	·03	..	·02	·01	·02	·03	·02	·01	·02	·03	·03	·01	·02	·01
23	·15	·15	·11	·13	·08	·16	·15	·13	·13	·12	·12	·09	·10	·10	·14	·18	·19	·10	·09	·12	·21	·08	·09	·08
24	·41	·39	·35	·26	·26	·32	·33	·32	·30	·17	·20	·10	·20	·25	·25	·19	·19	·27	·30	·30	·17	·25	·27	·29
25	·05	·05	·02	·02	·01	·02	·02	·03	·02	·02	·03	·02	·01	·01	·02	·03	·02	·02	·02	·03	·03	·02	·04	·03
26	·01	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..
27	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
28	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
29	..	..	..	..	..	..	..	..	..	·01	·01	..	..	..	..	..	·01	..	..	..	..	..	..	..
30	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
31	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Total	2·78	2·73	2·57	2·76	2·35	2·47	2·89	2·21	1·87	1·57	1·69	1·08	·95	1·46	1·62	1·61	1·53	1·98	1·97	2·18	1·90	1·82	1·97	2·47
From Jan. 1	6·93	6·71	6·01	5·95	5·47	5·74	6·59	5·37	4·92	4·65	4·93	3·56	3·60	4·47	4·93	4·94	4·60	5·24	4·87	5·69	4·97	4·78	5·09	5·63

Daily Rainfall. April, 1890.

Day of Month	Keston (Heathfld.)	Keston (Tow. Fds.)	Orpington	Farningham Hill	Wilmington	Chislehurst	Bickley	Beckenham	Wimbledon (Sew. Wks.)	Wimbledon (Mt. Ararat)	Raynes Park	New Malden
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	..	..	..	..	..	..	..	..	..	..	..
2	..	..	..	..	..	..	..	..	..	..	..	..
3	..	..	..	..	..	..	..	..	..	..	..	..
4	..	..	..	..	..	..	..	..	..	..	..	..
5	..	..	..	..	..	..	..	..	..	..	..	..
6	·07	·07	·05	·06	·04	·06	·05	·05	·06	·05	·05	·04
7	·12	·09	·07	·13	·04	·11	·07	·06	·06	·07	·06	·05
8	·07	·07	·09	·10	·08	·07	·10	·09	·03	..	·03	·01
9	·04	·04	·01	·02	·02	·04	·04	·04	·04	·08	·05	·05
10	·15	·15	·14	·11	·15	·13	·16	·05	·07	·07	·08	·04
11	..	..	..	·01	..	..	..	..	..	..	·01	..
12	..	..	..	..	..	..	..	..	..	..	..	..
13	..	..	..	..	..	..	..	..	..	..	..	..
14	·03	·03	·02	·02	·02	·03	·02	·02	·02	·01	·02	..
15	·28	·28	·25	·30	·32	·25	·25	·21	·21	·20	·19	·21
16	..	..	..	·01	..	·03	..	..	..	..	·02	..
17	·27	·19	·18	·25	·10	·15	·23	·20	·09	·10	·11	·10
18	·06	·14	·11	·08	·04	·03	·07	·04	..	·06	·04	·03
19	·01	..	..	..	..	..	..	..	·03	..	..	..
20	..	..	..	..	..	..	..	..	..	..	..	..
21	·10	·10	·10	·09	·09	·11	·12	·11	·11	·10	·10	·07
22	..	..	..	..	..	..	..	..	..	..	..	..
23	·16	·19	·15	·10	·08	·13	·14	·15	·17	·18	·19	·17
24	·20	·18	·18	·19	·17	·16	·19	·13	·06	·03	·05	·06
25	·60	·63	·58	·53	·48	·52	·58	·59	·73	·75	·69	·67
26	·03	·03	..	..	..	·01	·02	·02	·17	·24	·21	·08
27	·02	..	·04	·07	·09	·06	·04	·02	·01	..	..	·03
28	..	..	..	..	..	..	..	..	..	..	..	..
29	..	..	..	..	..	..	..	..	..	..	..	..
30	..	..	..	..	..	..	..	..	..	..	..	..
Total	2·21	2·19	1·97	2·07	1·72	1·89	2·08	1·78	1·86	1·94	1·90	1·61
From Jan. 1	9·14	8·90	7·98	8·02	7·19	7·63	8·67	7·15	6·78	6·59	6·83	5·17

Day of Month	Esher	Surbiton	Kingston	Richmond	Kew	Brixton	West Norwood	Sydenham	Forest Hill	Deptford	Greenwich	Eltham
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	..	..	..	..	..	..	..	..	..	..	..
2	..	..	..	..	..	..	..	..	..	..	..	..
3	..	..	..	..	..	..	..	..	..	..	..	..
4	..	..	..	..	..	..	..	..	..	..	..	..
5	..	..	..	..	..	..	..	..	..	..	..	..
6	..	·06	·05	·07	·06	·06	·05	..	·04	·05	·05	·07
7	·01	·10	·08	·10	·16	·07	·06	·13	·19	·02	·07	·06
8	·03	·02	·02	·03	·03	·09	·08	·15	·10	·06	·08	·10
9	·06	·06	·07	·05	·05	·05	·05	·06	..	·04	·05	·01
10	·03	·04	·05	·06	·03	·06	·05	·07	..	·05	·04	·13
11	..	..	..	..	..	..	..	..	..	..	..	..
12	..	..	..	..	..	..	..	..	..	..	..	..
13	..	..	..	..	..	..	..	..	..	..	..	..
14	..	·01	·01	·02	·02	·01	·02	·01	·01	·01	·03	·02
15	·11	·17	·22	·21	·23	·22	·18	·24	·20	·22	·26	·25
16	..	·01	..	..	..	..	..	..	·01	·02	·03	·03
17	·13	·12	·11	·12	·07	·05	·12	·16	·07	·05	·05	·17
18	..	·02	·02	·01	·01	·06	·05	·10	·09	·02	·04	·08
19	..	..	..	..	..	..	..	..	..	..	..	·01
20	..	..	..	..	..	..	..	..	..	..	..	..
21	·05	·06	·09	·12	·12	·11	·10	·11	·10	·11	·11	·10
22	..	..	..	·03	·02	..	..	..	..	..	..	·01
23	·02	·19	·21	·18	·25	·13	·14	·15	·13	·10	·11	·11
24	·08	·08	·12	·11	·25	·08	·11	·12	·09	·07	·09	·13
25	·66	·69	·75	·56	·30	·66	·55	·57	·47	·58	·58	·60
26	·22	·02	·06	·27	·12	·22	·13	·07	..	·16	·11	·03
27	·02	·01	·04	..	..	·02	·02	..	..	·03	·07	·06
28	..	..	..	..	·01	..	..	..	..	·01	..	·03
29	..	..	..	..	..	..	..	..	..	..	..	..
30	..	..	..	..	..	..	..	..	..	..	..	..
Total	1·42	1·66	1·90	1·94	1·73	1·89	1·71	1·94	1·50	1·60	1·77	2·00
From Jan. 1	5·02	6·13	6·83	6·88	6·33	7·13	6·58	7·63	6·47	6·38	6·86	7·63

Daily Rainfall. April, 1890.

Day of Month	Dorking	ReigateHill	Caterham	Marden Park	Kenley	Purley (Reedham)	Purley (Tudor C.)	Ashtead	Sutton	Carshalton	Wallington	Bedding-ton	Waddon	Croydon (Brim. Bn.)	Croydon (Limes Rd.)	Croydon (Whitgift)	Addiscmb. (Hvlk. Rd.)	Addiscmb. (Outm. Rd.)	Addington Hills	Addington (Park Fm.)	Addington (Pump. St.)	West Wickham	Hayes Common	Keston (Bradfield)
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
4	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
6	·07	·06	..	·08	·08	·07	·06	·06	·06	·05	·06	·06	·05	·05	·06	·05	·06	·05	·07	·03	·05	·07	·05	·05
7	·10	·08	·11	·03	·06	·04	·05	·08	·06	·08	·07	·08	·09	·08	·11	·09	·14	·12	·12	·13	·12	·05	·10	·12
8	..	·01	·08	·05	..	·03	·05	·05	·02	·01	·03	·03	·05	·06	·06	·07	·09	·09	·07	·09	·07	·10	·10	·09
9	·10	·06	·08	·06	·10	·09	·08	·10	·09	·08	·08	·07	·07	·06	·05	·06	·06	·06	·05	·05	·06	·05	·04	·04
10	·06	·06	·07	·12	·05	·06	·06	·12	·05	·05	·05	·05	·05	·05	·05	·06	·07	·06	·05	·09	·09	·15	·11	·15
11	..	..	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	·01	..
12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
13	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
14	·02	·02	..	·02	·03	·03	·03	..	·03	·01	·02	[illegible]	·02	·02	·01	·03	..	·02	·02	·02	·02	·02	·02	·03
15	·10	·06	·12	·14	·19	·19	·20	·11	·19	·23	·22	·27	·25	·23	·23	·25	·26	·22	·23	·25	·24	·28	·27	·26
16	..	·01	..	..	..	..	·01	·04	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..
17	·50	·40	·42	·38	·19	·28	·37	·27	·23	·24	·22	·20	·18	·19	·24	·26	·18	·25	·31	·14	·21	·31	·28	·21
18	·17	·25	·05	..	·11	·12	·05	·14	·07	·02	·11	·07	·09	·06	·02	·03	·10	·05	·03	·23	·05	..	·06	·11
19	..	·01	..	..	..	·01	·02	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..
20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
21	·07	·08	·12	·03	·08	·06	·07	·06	·07	·06	·07	·08	·07	·09	·09	·08	·09	·09	·09	·08	·08	·08	·10	·09
22	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..
23	·30	32	·29	·27	·20	·19	·18	·28	·18	·14	·14	·14	·14	·14	·15	·15	·16	·15	.17	·14	·14	·17	·16	·15
24	·15	·30	·26	·25	·16	·14	·14	·18	·13	·19	·13	·13	·15	·12	·50	·15	·16	·16	·15	·12	·12	·17	·17	·18
25	·82	·98	·70	·69	·68	·72	·70	·82	·65	·55	·62	·62	·61	·44	·24	·59	·58	·59	·57	.66	·57	·73	·57	·59
26	..	·01	·27	·27	·22	·27	·22	·03	·10	·05	·10	·11	·08	·08	·10	·11	·12	·11	·14	·09	·15	·07	·02	·03
27	..	·03	·15	·10	·03	·03	·02	..	·05	·02	·01	·01	·01	·01	·01	..	..	·01	·01	·01	·01	·01	·01	·01
28	..	·02	..	·01	..	..	..	·03	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
29	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
30	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Total	2·46	2·76	2·72	2·55	2·18	2·33	2·32	2·38	1·98	1·79	1·93	1·94	1·91	1·68	1·92	1·98	2·07	2·03	2·08	2·14	1·98	2·26	2·09	2·11
From Jan. 1	9·81	10·83	10·49	9·84	9·11	8·66	9·30	8·87	7·61	6·89	7·83	7·57	7·27	6·09	7·34	7·98	8·01	7·91	8·14	7·89	8·25	8·92	8·22	8·03

Day of Month	Dorking	ReigateHill	Caterham	Marden Park	Kenley	Purley (Reedham)	Purley (Tudor C.)	Ashtead	Sutton	Carshalton	Wallington	Bedding-ton	Waddon	Croydon (Brim. Bn.)	Croydon (Limes Rd.)	Croydon (Whitgift)	Addiscmb. (Hvlk. Rd.)	Addiscmb. (Outm.Rd.)	Addington Hills	Addington (Park Fm.)	Addington (Pump. St.)	West Wickham	Hayes Common	Keston (Bradfield)
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
3	·03	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
4	·09	·06	·07	·07	·10	·11	·12	·10	·13	·13	·11	·12	·11	·10	·19	·14	·18	·17	·12	·10	·12	·13	·11	·13
5	·02	·01	..	·02	·01	·02	·03	..	·02	·01	·02	·03	·03	·05	·01	·01	·02	·03	·02	·06	·01	·01	·01	·01
6	·03	·01	·05	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
7	..	..	·10	·35	·21	·27	·12	·08	·19	·22	·22	·11	·06	·05	·05	·05	·05	·05	·04	·02	·06	·27	·05	·03
8	..	..	..	·01	..	·01	·02	..	·02	·01	·01	·02	·02	·03	·02	·03	·05	·03	·02	..	·01	·02	·05	·06
9	·55	·61	·42	·45	·28	·28	·30	·41	·29	·28	·31	·29	·28	·30	·32	·30	·30	·28	·31	·28	·25	·31	·27	·29
10	·2[illegible]	·41	·63	·41	·49	·50	·47	·30	·43	·44	·43	·38	·39	·35	·40	·41	·48	·42	·47	·49	·47	·53	·46	·48
11	·20	·23	·20	·15	·22	·21	·25	·34	·18	·15	·18	·18	·19	·18	·16	·17	·18	·17	·18	·15	·16	·17	·15	·13
12	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	..	..	..	·01	..	..	·01	..
13	·02	·01	..	·01	..	..	·02	·04	..	·02	·02	·03	·02	·03	·01	·02	·02	·01	..	..	·01	..	·01	·01
14	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..
15	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
16	·20	·20	·24	·14	·22	·23	·21	·18	·17	·15	·20	·19	·19	·14	·13	·16	·14	·15	·17	·11	·11	·10	·10	·10
17	..	·02	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	·01	·01	·02	·01	·02
18	..	·01	..	·03	·04	·03	·04	..	·02	·02	·03	·04	·03	·03	·02	·04	·03	·03	·04	·02	·02	·03	·05	·03
19	·11	·08	·12	·09	·13	·11	·11	·13	·12	·05	·06	·08	·09	·05	·04	·05	·05	·05	·05	..	·06	·05	·06	·07
20	·02	·01	..	..	·01	..	..	·04	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..
21	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
22	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
23	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
24	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
25	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
26	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
27	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
28	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
29	·10	·15	·15	·09	·11	·11	·10	·16	·10	·10	·12	·13	·13	·10	·13	·15	·14	·13	·12	·12	·12	·10	·13	·12
30	..	·02	..	·02	..	..	·05	·04	..	..	..	..	..	..	..	..	..	..	·01	..	..	·02	..	·03
31	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Total	1·59	1·83	1·98	1·86	1·82	1·88	1·84	1·82	1·67	1·58	1·73	1·60	1·54	1·41	1·48	1·53	1·65	1·52	1·55	1·37	1·41	1·76	1·48	1·51
From Jan. 1	11·40	12·66	12·47	11·70	10·93	10·54	11·14	10·69	9·28	8·47	9·56	9·17	8·81	7·50	8·82	9·51	9·66	9·43	9·69	9·26	9·66	10·68	9·70	9·54

Day of Month	Keston (Heathfld.)	Keston (Tow. Fds.)	Orpington	Farningham Hill	Wilmington	Chislehurst	Bickley	Beckenham	Wimbledon (Sew. Wks.)	Wimbledon (Mt. Ararat)	Raynes Park	New Malden	Esher	Surbiton	Kingston	Richmond	Kew	Brixton	West Norwood	Sydenham	Forest Hill	Deptford	Greenwich	Eltham
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
4	·13	·11	·07	·03	·10	·06	·06	·06	·11	·16	·14	·15	·06	·12	·15	·15	·19	·06	·09	·07	·05	·06	·09	·07
5	·02	·02	·01	·03	·01	·04	·01	·03	·07	·05	·05	·03	·07	·01	·05	·06	·01	·07	·05	·05	·04	·05	·02	·06
6	·01	..	..	·01	..	..	..	..	..	..	..	..	..	..	·01	·01	·01	..	..	..	..	..	..	·01
7	·07	·03	·01	·05	·04	·02	·05	·03	·03	..	·04	·06	·02	·03	·08	·03	·05	·02	·02	..	..	·01	·07	·01
8	·05	·06	·08	·02	·04	·03	·04	·03	..	·05	·03	·02	·20	..	·02	·01	·01	·02	·02	·07	..	·02	·03	·03
9	·26	·28	·29	·37	·31	·36	·33	·35	·43	·43	·39	·40	·42	·39	·45	·50	·52	·42	·46	·45	·45	·36	·33	·38
10	·45	·48	·40	·58	·44	·52	·56	·45	·27	·31	·32	·27	..	·22	·27	·15	·14	·30	·41	·56	·53	·39	·40	·50
11	·17	·13	·09	·07	·12	·12	·13	·10	·15	·16	·16	·20	·09	·24	·23	·18	·15	·08	·11	·12	·10	·10	·11	·10
12	·01	..	·02	·01	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01
13	·02	·01	..	..	..	..	·01	·01	·01	..	·02	..	·02	·01	·01	·01	·02	..	·01	..	..	·01	·01	·02
14	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
15	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
16	·11	·02	·10	·09	·07	·09	·06	·07	·07	·08	·09	·06	..	·10	·10	·10	·10	·10	·11	·11	·10	·05	·05	·06
17	·03	·03	·05	·02	·01	·03	·02	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	·01	·04
18	·03	·03	·02	·01	..	·02	·02	·03	·03	·01	·01	..	..	..	..	..	·01	·03	·03	..	·03	·02	·03	·02
19	·07	·06	·10	·12	·11	·09	·10	·05	·05	·07	·07	·09	..	·10	·09	·13	·11	·10	·07	·10	·06	·10	·12	·09
20	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·02
21	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
22	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
23	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
24	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
25	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
26	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
27	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
28	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
29	·13	·13	·08	·03	·09	·07	·10	·09	·10	·10	·14	·07	·10	·09	·09	·10	·10	·06	·12	·10	·06	·07	·07	·08
30	·01	..	..	·04	..	..	..	..	..	..	·01	..	..	..	..	..	..	·02	..	..	·04	..	..	·01
31	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Total	1·58	1·39	1·32	1·48	1·34	1·46	1·49	1·30	1·32	1·42	1·47	1·35	0·98	1·31	1·55	1·43	1·42	1·29	1·50	1·63	1·46	1·24	1·34	1·51
From Jan. 1	10·72	10·29	9·30	9·50	8·53	9·09	10·16	8·45	8·10	8·01	8·30	6·52	6·00	7·44	8·38	8·31	7·75	8·42	8·08	9·26	7·93	7·62	8·20	9·14

Day of Month	Dorking	ReigateHill	Caterham	Marden Park	Kenley	Purley (Reedham)	Purley (Tudor C.)	Ashtead	Sutton	Carshalton	Wallington	Bedding-ton
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	·02	..	..	..	..	..	..	..	..	..	..
2	..	..	..	..	..	..	..	..	..	..	..	..
3	·07	·04	..	·05	·02	·02	·03	·07	·07	·10	·03	·04
4	·22	·32	·35	·23	·25	·21	·20	·26	·22	·15	·23	·23
5	..	·02	..	·02	·03	·02	·03	·03	·02	·02	·01	·01
6	·02	..	..	..	..	..	..	..	..	..	..	..
7	..	..	..	..	..	..	..	..	..	..	..	..
8	·13	·16	·22	·19	·16	·14	·12	·10	·10	·09	·10	·10
9	..	..	..	..	..	..	..	..	..	..	..	..
10	·19	·33	·26	·20	·23	·20	·20	·16	·19	·18	·16	·15
11	·26	·26	·06	·05	·20	·17	·16	·50	·41	·49	·30	·26
12	·27	·18	·05	·07	·02	·02	·03	·14	·56	·37	·08	·06
13	..	·02	..	·01	·02	·01	·02	·02	..	·01	·02	·01
14	..	..	..	..	..	..	..	..	·02	..	..	..
15	..	..	..	..	..	..	..	..	..	..	..	..
16	·16	·16	·17	·15	·16	·13	·17	·16	·15	·15	·16	·16
17	·07	·08	·06	·05	·09	·09	·09	·06	·05	·04	·05	·05
18	..	·02	..	·01	·02	·01	·02	·03	·01	..	..	..
19	..	..	..	..	..	..	..	..	..	..	..	..
20	..	..	..	..	..	..	..	..	..	..	..	..
21	·17	·14	·15	·13	·10	·10	·14	·17	·12	·24	·15	·14
22	·05	·03	..	·01	·03	·03	·03	·07	·05	·03	·03	·02
23	..	..	·06	·01	·01	..	..	..	..	..	..	..
24	..	..	..	..	..	..	..	..	..	..	..	..
25	·15	·10	·11	·10	·11	·12	·11	·18	·15	·14	·15	·15
26	·15	·13	..	·08	·13	·12	·14	·20	·17	·15	·19	·17
27	..	..	..	..	·01	..	·02	..	..	·01	·01	·01
28	·22	·28	·65	·41	·31	·30	·31	·23	·54	·69	·35	·37
29	·25	·21	·30	·29	·25	·20	·20	·17	·16	·12	·13	·12
30	·58	·35	·35	·44	·49	·36	·35	·46	·28	·26	·29	·25
Total	2·96	2·85	2·79	2·53	2·64	2·25	2·37	3·01	3·27	3·24	2·44	2·30
From Jan. 1	14·36	15·51	15·26	14·23	13·57	12·79	13·51	13·70	12·55	11·71	12·00	11·47

Day of Month	Waddon	Croydon (Brim. Bn.)	Croydon (Limes Rd.)	Croydon (Whitgift)	Addiscmb. (Hvlk. Rd.)	Addiscmb. (Outm. Rd.)	Addington Hills	Addington (Park Fm.)	Addington (Pump. St.)	West Wickham	Hayes Common	Keston (Bradfield)
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	..	..	..	..	..	..	..	..	..	·01	..
2	..	..	..	..	..	..	..	..	..	..	..	..
3	·05	..	·12	·03	·05	·04	·03	·03	·03	..	·03	·02
4	·20	·26	·15	·24	·19	·19	·20	·21	·20	·22	·20	·20
5	·01	..	·01	·02	·01	·01	·01	·02	·01	..	·01	·01
6	..	..	..	..	..	..	..	..	..	..	..	..
7	..	..	..	..	..	..	..	..	..	..	..	..
8	08	·12	·11	·11	·12	·11	·11	·11	·12	·12	·10	·10
9	..	..	..	..	..	..	..	..	..	..	..	..
10	·16	·16	·18	·18	·17	·16	·18	·21	·21	·21	·18	·17
11	·23	·26	·27	·25	·17	·16	·21	·37	·34	·18	·35	·22
12	·05	·06	·04	·05	·09	·09	·02	·01	·01	·08	·07	·27
13	·01	·02	..	·01	·01	·01	·01	·02	·01	·02	·02	·02
14	..	..	..	..	..	..	..	..	..	..	..	..
15	..	..	..	..	..	..	..	..	..	..	..	..
16	·16	·16	·17	·16	·16	·15	·17	·15	·16	·19	·16	·15
17	·05	·06	·06	·05	·07	·06	·09	·09	·10	·09	·09	·10
18	..	..	..	..	·01	..	..	·01	·01	·01	·01	..
19	..	..	..	..	..	..	..	..	..	..	..	..
20	..	..	..	..	..	..	..	..	..	..	..	..
21	·15	·20	·18	·16	19	·18	·14	·08	·08	·08	·14	·10
22	·02	·02	·02	·04	·03	·02	·04	·02	·02	·03	·03	·03
23	..	..	..	..	..	..	..	..	..	..	..	..
24	..	..	..	..	..	..	..	..	..	..	..	..
25	·15	·15	·16	·14	·13	·13	·11	·09	·10	·09	·09	·09
26	·16	·19	·21	·16	·14	·12	·14	·12	·10	·10	·10	·09
27	·01	..	..	·01	·02	..	..	..	·01	..	..	..
28	·38	·39	·36	·41	·41	·40	·32	·28	·36	·30	·32	·27
29	·11	·10	·18	·13	·19	·18	·28	·18	·21	·16	·25	·15
30	·26	·21	·15	·25	·23	·23	·30	·38	·37	·46	·32	·36
Total	2·24	2·36	2·37	2·40	2·39	2·24	2·30	2·38	2·45	2·34	2·48	2·35
From Jan. 1	11·05	9·86	11·19	11·91	12·05	11·67	12·05	11·64	12·11	13·02	12·18	11·89

Daily Rainfall.

Day of Month	Keston (Heathfd.)	Keston (Tow. Fds.)	Orpington	Farningham Hill	Wilmington	Chislehurst	Bickley	Beckenham	Wimbledon (Sew. Wks.)	Wimbledon (Mt. Ararat)	Raynes Park	New Malden	Esher	Surbiton	Kingston	Richmond	Kew	Brixton	West Norwood	Sydenham	Forest Hill	Deptford	Greenwich	Eltham
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·01	..	..	..	·01	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
3	·05	..	·02	·03	·06	..	·07	·03	·03	..	·02	..	·03	·04	·05	·03	·05	..	·02	..	·04	·01	·02	·01
4	·20	·24	·20	·27	·27	·31	·22	·24	·25	·28	·24	·27	·28	·24	·29	·34	·29	·33	·30	·35	·28	·25	·29	·30
5	·02	..	·01	·01	·01	·01	·01	·01	·02	·01	·02	..	·02	..	·01	·01	..	·01	·01	..	..	..	·01	·01
6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
7	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
8	·11	·12	·09	·10	·12	·12	·12	·12	·16	·17	·17	·15	·09	·14	·18	·20	·19	·17	·15	·16	·10	·13	·16	·13
9	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
10	·17	·15	·21	·17	·16	·19	·15	·17	·18	·19	·20	·19	·11	·17	·20	·20	·18	·16	·16	·20	·15	·13	·14	·28
11	·20	·30	·06	·05	·09	·24	·14	·31	·20	·18	·18	·19	·30	·27	·27	·21	·26	·30	·27	·31	·25	·33	·32	·24
12	·23	·23	·01	·09	·09	·05	·36	·15	·27	·13	·19	..	·20	·06	·09	·10	·13	·65	·12	·09	·03	·08	·11	·19
13	·02	·01	..	·01	·01	·01	..	·01	·01	·03	..	..	·01	..	..	·01	..	·02	·01	·01	·07	..	·01	·01
14	..	..	..	..	..	..	..	..	..	..	·01	..	·02	..	..	..	..	·01	·01	..	..	..	..	..
15	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
16	·16	·17	·13	·14	·11	·15	·15	·16	·14	·05	·15	·10	·09	·10	·12	·14	·14	·11	·18	..	·04	·13	·13	·13
17	·12	·12	·08	·11	·06	·09	·11	·08	·03	·04	·04	·02	·02	·02	·02	·02	·01	·04	·04	·24	·17	·01	·04	·05
18	·02	..	..	..	·01	·01	..	..	·02	..	·01	..	·01	..	..	..	..	..	·01	·01	·02	..	·01	·02
19	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
21	·10	·11	·10	·11	·11	·17	·22	·22	·15	·20	·18	·27	·19	·25	·31	·28	·27	·20	·18	·30	·38	·23	·20	·14
22	·03	·03	..	..	..	·02	·02	·02	·04	·04	·05	·06	·05	·11	·06	·06	·05	·04	·04	..	·03	·01	·01	·01
23	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	·01	..	..	..	..	..	·01	..
24	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	·03	..	..	..	·02	·03	·01
25	·10	·11	·06	·07	·08	·09	·09	·15	·13	·18	·15	·13	·11	·12	·13	·15	·18	·08	·15	·15	·08	·11	·12	·14
26	·10	·10	·09	·08	·07	·12	·15	·19	·12	·09	·18	·10	·01	·12	·12	·15	·17	·10	·15	·19	·19	·12	·16	·22
27	·01	..	..	..	..	·01	..	·02	..	·01	·04	·02	..	·02	·01	·04	..	·06	·01	..	..	·01	·02	·04
28	·33	·35	·31	·35	·37	·49	·55	·49	·57	·48	·48	·50	·44	·60	·57	·80	·96	·57	·52	·64	·63	·50	·43	·60
29	·19	·15	·13	·08	·06	·12	·15	·10	·09	·12	·11	·08	·13	·10	·13	·12	·20	·07	·07	·10	·07	·13	·11	·10
30	·42	·38	·30	·34	·22	·28	·20	·24	·20	·22	·23	·19	·30	·29	·25	·30	·29	·22	·21	·21	·21	·18	·20	·25
Total	2·61	2·57	1·80	2·01	1·91	2·49	2·71	2·71	2·61	2·42	2·60	2·27	2·43	2·65	2·81	3·16	3·38	3·17	2·61	2·96	2·74	2·38	2·53	2·88
From Jan. 1	13·33	12·86	11·10	11·51	10·44	11·58	12·87	11·16	10·71	10·43	10·90	8·79	8·43	10·09	11·19	11·47	11·13	11·59	10·69	12·22	10·67	10·00	10·73	12·02

Day of Month	Dorking	ReigateHill	Caterham	Marden Park	Kenley	Purley (Reedham)	Purley (Tudor C.)	Ashtead	Sutton	Carshalton	Wallington	Bedding-ton
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·02	·31	·15	·10	·26	·34	·34	·08	·35	·41	·48	·47
2	·02	·01	·15	·19	..	..	·03	..	..	..	..	..
3	..	·02	·03	·03	·02	·03	·02	·10	·05	·04	·04	·03
4	1·02	1·31	1·25	1·25	1·16	1·14	1·23	·95	·90	1·10	·95	1·01
5	·50	·37	·45	·45	·41	·49	·55	·44	·40	·23	·53	·51
6	..	..	..	..	..	..	·01	..	·02	·01	·01	·01
7	·45	·51	·40	·40	·38	·30	·32	·22	·23	·20	·23	·21
8	..	·01	·08	..	..	..	·01	..	..	..	·01	..
9	·14	·23	·17	·03	·15	·18	·15	·24	·15	·11	·13	·13
10	·31	·35	·48	·45	·43	·35	·33	·27	·33	·35	·41	·43
11	·02	·17	·19	·15	·17	·28	·23	·05	·18	·33	·34	·17
12	·02	·05	·03	·02	·03	..	·02	..	..	..	..	..
13	·03	·05	·03	·03	·03	..	·02	..	..	..	..	..
14	..	·01	..	..	..	·02	..	..	..	..	..	·01
15	..	..	..	..	..	..	..	..	..	..	..	..
16	..	..	..	..	..	..	·01	..	·02	·01	·01	·01
17	1·30	·93	·62	·83	·94	1·07	1·83	1·25	1·35	1·24	1·55	1·38
18	·35	·45	·44	·45	·42	·41	·52	·54	·53	·39	·58	·48
19	·07	·05	..	·02	..	..	..	·05	·04	·01	..	..
20	..	..	..	..	..	..	..	..	..	..	..	..
21	..	..	..	..	..	..	..	..	..	..	..	..
22	..	..	..	..	..	..	·01	..	..	..	..	..
23	..	..	..	..	..	..	·01	..	..	..	..	..
24	..	·04	..	..	..	..	·01	..	..	..	..	..
25	·03	·03	..	·01	..	·03	·03	·04	·01	·01	·01	·02
26	..	..	..	·02	·02	..	·01	..	·04	..	..	..
27	·02	..	..	..	..	·03	·02	..	..	..	..	·01
28	..	..	..	..	·03	..	·03	..	..	..	..	..
29	..	·01	·02	·02	·04	·03	·04	·06	·04	·01	·03	·03
30	..	..	..	..	..	..	·01	..	..	..	..	..
31	..	..	..	..	..	..	..	..	..	..	..	..
Total	4·30	4·91	4·49	4·45	4·49	4·70	5·79	4·29	4·64	4·45	5·31	4·91
From Jan. 1	18·66	20·42	19·75	18·68	18·06	17·49	19·30	17·99	17·19	16·16	17·31	16·38

Day of Month	Waddon	Croydon (Brin. Bn.)	Croydon (Limes Rd.)	Croydon (Whitgift)	Addiscmb. (Hvlk. Rd.)	Addiscmb. (Outm. Rd.)	Addington Hills	Addington (Park Fm.)	Addington (Pump. St.)	West Wickham	Hayes Common	Keston (Bradfield)
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·35	·28	·35	·28	·42	·43	·38	·50	·40	·26	·17	·23
2	..	..	..	·01	·01	..	..	..	..	·01	·01	..
3	·03	·04	·02	·04	·03	..	·04	·02	..	·01	·02	·02
4	·97	·64	1·05	1·05	1·01	1·06	1·13	·95	1·10	1·07	1·18	1·03
5	·50	·30	·37	·54	·55	·52	·55	·74	·55	·80	·56	·61
6	·01	·01	·01	·02	·01	·01	..	·01	·01	·01	·01	·01
7	·18	·16	·20	·22	·21	·21	·21	·24	·29	·27	·19	·21
8	·01	..	..	·01	·01	..	..	·01	..	·02	·01	·01
9	·12	·12	·13	·15	·15	·14	·14	·11	·12	·12	·01	·09
10	·34	·36	·35	·41	·36	·36	·35	·27	·32	·51	·10	·35
11	·21	·10	·04	·04	·07	·06	·13	·22	·19	·23	·33	·20
12	..	..	..	..	·01	..	·01	·01	·01	·01	·21	·01
13	..	..	..	..	·01	·01	·01	·01	·02	·02	·01	·02
14	..	..	..	..	..	..	..	..	..	..	·01	..
15	..	..	..	..	..	..	..	..	..	..	..	..
16	·01	..	·01	·01	·01	·01	..	..	..	..	..	..
17	1·25	1·23	·90	1·10	1·03	·99	1·04	·82	·83	1·13	·63	·71
18	·45	·55	·53	·52	·51	·52	·57	·54	·66	·58	·47	·56
19	..	..	..	..	·01	·01	·03	·01	..	·01	·01	·01
20	..	..	..	..	..	..	..	..	..	..	..	..
21	..	..	..	..	..	..	..	..	..	..	..	..
22	..	..	..	..	..	..	..	..	..	..	..	..
23	..	..	..	..	..	..	..	..	..	..	..	..
24	..	..	·01	·02	·02	·01	..	·01	..	..	·02	·01
25	·02	..	·02	·03	·03	·02	·03	·02	·02	·02	..	·03
26	..	·02	..	..	..	..	..	·01	..	..	..	·01
27	·03	..	·01	..	..	..	..	..	..	..	..	..
28	..	..	..	·03	·04	·04	·04	..	..	..	..	..
29	·03	·03	·02	·03	·02	·02	·03	·02	·02	..	·03	·02
30	..	..	..	..	..	..	..	·01	..	..	..	..
31	..	..	..	..	..	..	..	..	..	..	..	..
Total	4·51	3·84	4·02	4·51	4·52	4·42	4·69	4·53	4·54	5·08	3·98	4·19
From Jan. 1	15·56	13·70	15·21	16·42	16·57	16·09	16·74	16·17	16·65	18·10	16·16	16·08

Daily Rainfall. July, 1890.

Day of Month	Keston (Heathfd.)	Keston (Tow. Fds.)	Orpington	Farning-ham Hill	Wilming-ton	Chislehurst	Bickley	Beckenham	Wimbledon (Sew. Wks.)	Wimbledon (Mt. Ararat)	Raynes Park	New Malden
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·20	·11	·17	·14	·04	·03	·07	·15	·24	·40	·40	·18
2	·01	..	·03	·14	·05	..	..	..	·01	..	..	·01
3	·01	..	·02	·03	·03	·03	..	·01	·06	·06	·07	·11
4	1·20	1·16	1·18	1·10	1·03	1·07	1·50	1·04	·81	·94	·82	·71
5	·56	·68	·65	·52	·21	·34	·34	·49	·36	·40	·39	·30
6	·02	..	..	·02	·02	..	..	·01	·01	·01	·01	·01
7	·27	·24	·25	·20	·11	·15	·16	·17	·20	·22	·22	·18
8	·01	..	..	..	·01	..	..	..	..	..	·01	..
9	·10	·11	·07	·10	·10	·16	·13	·11	·08	·10	·09	·10
10	·40	·39	·38	·20	·25	·37	·36	·43	·32	·27	·29	·25
11	·16	·14	·10	·12	·09	·13	·16	·13	·16	·19	·22	·10
12	·02	·01	..	..	..	..	..	..	·01	..	..	..
13	·03	·01	·02	·01	..	..	..	..	..	..	..	..
14	·01	..	..	..	..	..	..	..	..	..	..	..
15	..	..	..	..	..	..	..	..	..	..	..	..
16	..	..	..	..	..	..	..	..	..	..	..	..
17	·66	·56	·80	·66	1·07	·46	·46	·67	1·42	1·60	1·53	1·14
18	·58	·45	·44	·38	·34	·42	·46	·45	·38	·39	·38	·31
19	·02	..	..	..	·01	..	·01	..	·02	·05	·05	..
20	·01	..	..	..	..	..	..	..	..	..	..	..
21	..	..	..	..	..	..	..	..	..	..	..	..
22	..	..	..	..	..	..	..	..	..	..	..	..
23	..	..	..	..	·01	..	..	..	..	..	..	..
24	·02	..	..	·01	..	·02	..	..	..	..	·01	..
25	·03	·04	..	·03	·02	·03	..	·03	·02	·02	·03	..
26	·01	..	..	..	..	..	·02	·01	..	·01	..	·03
27	..	..	..	..	..	..	..	..	..	..	..	..
28	·01	..	..	..	..	·03	·02	·01	..	·01	..	..
29	·02	·02	·01	..	..	·02	·01	·01	·05	·02	·04	..
30	..	..	..	..	..	..	..	..	..	..	..	..
31	..	..	..	..	..	..	·01	..	..	..	..	..
Total	4·36	3·92	4·12	3·66	3·39	3·26	3·71	3·72	4·15	4·69	4·56	3·41
From Jan. 1	17·69	16·78	15·22	15·17	13·83	14·84	16·58	14·88	14·86	15·12	15·46	12·20

Day of Month	Esher	Surbiton	Kingston	Richmond	Kew	Brixton	West Norwood	Sydenham	Forest Hill	Deptford	Greenwich	Eltham
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·07	·14	·09	·10	·10	·25	·57	·26	·04	·13	·10	·05
2	·01	..	·01	·01	·01	..	·01	..	·03	·01	·01	..
3	·09	·13	·09	·04	·08	·06	·10	·11	·07	·01	·02	·12
4	·80	·83	·83	·65	·70	·80	·88	1·12	1·02	·89	·94	1·03
5	·25	·29	·22	·19	·11	·56	·45	·50	·38	·39	·40	·33
6	·01	·01	..	..	·01	·01	·01	·01	·02	..	..	·01
7	·16	·19	·21	·22	·19	·23	·19	·20	·18	·24	·25	·17
8	..	..	..	..	..	..	..	..	..	..	..	..
9	·17	·12	·11	·10	·12	·12	·10	·09	·12	·08	·11	·12
10	·28	·23	·33	·29	·31	·30	·38	·40	·38	·36	·40	·42
11	·02	·04	·06	·06	·06	·05	·04	·12	·18	·15	·10	·10
12	·01	..	..	..	..	..	..	..	..	..	..	·01
13	·01	..	..	..	..	..	..	·01	..	..	..	..
14	..	..	..	..	..	..	..	..	..	..	..	..
15	..	..	..	..	..	..	..	..	..	..	..	..
16	..	..	..	..	·01	·01	·01	·01	..	..	·01	..
17	1·72	1·48	2·62	2·27	2·28	1·79	2·47	1·70	1·62	1·82	1·62	·60
18	·32	·32	·34	·37	·40	·47	·46	·45	·38	·48	·45	·57
19	·04	·01	·01	·02	·02	·01	..	..	..	..	..	·01
20	..	..	..	..	..	..	..	..	..	..	..	..
21	..	..	..	..	..	..	..	..	..	..	..	..
22	..	..	..	..	..	..	..	..	..	..	..	..
23	..	..	..	..	..	..	..	..	..	..	..	..
24	..	..	..	..	..	..	·01	·01	·03	..	·02	·03
25	..	·03	·02	·04	·03	·04	·02	·02	·01	·03	·05	·05
26	..	..	·02	·01	·01	·03	..	..	..	·01	·01	·01
27	..	..	..	..	..	..	..	..	..	..	..	..
28	..	..	..	..	..	..	..	..	..	..	..	·02
29	..	..	·01	·04	·02	·02	·02	·01	·01	·01	·01	..
30	..	..	..	..	..	..	..	..	..	..	..	..
31	·02	..	..	..	..	..	..	..	..	..	..	..
Total	3·98	3·82	4·97	4·41	4·46	4·75	5·72	5·02	4·47	4·61	4·50	3·65
From Jan. 1	12·41	13·91	16·16	15·88	15·59	16·34	16·41	17·24	15·14	14·61	15·23	15·67

Daily Rainfall **August, 1890.**

Day of Month	Dorking	ReigateHill	Caterham	Marden Park	Kenley	Purley (Reedham)	Purley (Tudor C.)	Ashtead	Sutton	Carshalton	Wallington	Bedding-ton	Waddon	Croydon (Brim. Bn.)	Croydon (Limes Rd.)	Croydon (Whitgift)	Addiscomb. (Hvlk. Rd.)	Addiscomb. (Outm.Rd.)	Addington Hills	Addington (Park Fm.)	Addington (Pump. St.)	West Wickham	Hayes Common	Keston (Bradfield)
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
2	·16	·08	·14	·07	·15	·12	·12	·10	·13	·09	·08	·09	·12	·12	·08	·10	·08	·08	·09	·10	·09	·14	·12	·12
3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
4	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
7	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
8	·03	·04	·04	·03	..	·02	·03	..	..	..	..	..	..	..	..	..	·01	..	·02	·02	·01	·01	·02	·02
9	·30	·34	·42	·33	·41	·40	·45	·27	·29	·33	·32	·33	·36	·36	·35	·37	·40	·40	·40	·39	·35	·40	·35	·40
10	·30	·28	·20	·27	·19	·18	·17	·25	·19	·10	·18	·17	·18	·16	·17	·17	·16	·15	·18	·17	·18	·20	·16	·17
11	·55	·42	·31	·18	·15	·19	·27	·22	·04	·03	·06	·02	·03	·03	·01	·02	·01	·01	·08	·10	·24	·22	·01	·05
12	·03	·05	..	·04	..	·02	..	..	..	..	..	·01	..	·03	·04	·02	·01	·02	..	..	·01	..	·01	·02
13	..	..	..	·08	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	..	..	..	·01	..	..
14	·12	·08	·10	..	·09	·05	·06	·05	·04	·01	·02	·02	·02	·02	..	·02	·03	·02	·04	..	·05	·05	·03	·03
15	·09	·02	..	·07	·02	·02	·05	·23	·10	·08	·08	·09	·10	·10	·08	·11	·13	·10	·05	·02	·03	·01	·03	·01
16	..	·02	·08	..	..	·01	·04	..	..	..	..	..	..	..	..	..	..	·01	·03	·04	·01	·17	·03	·03
17	..	·01	..	..	..	..	..	·03	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01
18	·11	·30	·23	·20	·20	·20	·27	·10	·21	·20	·22	·22	·24	·25	·30	·24	·16	·17	·21	·09	·18	·11	·15	·15
19	·42	·43	·82	·77	·85	·82	·71	·35	·44	·42	·52	·54	·55	·59	·46	·54	·62	·61	·64	·67	·71	·81	·56	·76
20	..	·01	..	·01	..	..	·01	..	..	..	..	..	·01	..	..	..	..	..	..	·01	·01	..	..	·02
21	·02	·03	·03	·02	·03	·02	·01	..	·02	·01	·01	·01	·01	·02	·01	·02	·02	·02	·02	..	·01	·02	·01	·01
22	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
23	·25	·18	·20	·13	·09	·07	·10	·22	·09	·15	·10	·18	·14	·20	·06	·16	·17	·16	·11	·19	·06	·04	·08	·07
24	·52	·15	·10	·11	·11	·12	·17	·10	·28	·15	·13	·09	·14	·30	·35	·25	·39	·36	·17	·09	·10	·18	·24	·12
25	·10	·10	·09	·08	·10	·10	·09	·14	·15	·14	·11	·13	·12	·15	·16	·14	·11	·10	·08	·20	·10	·04	·13	·07
26	·22	·18	·23	·23	·20	·17	·17	·16	·13	·13	·15	·12	·15	·14	·13	·15	·19	·17	·27	..	·15	·18	·26	·13
27	·12	·08	·10	·09	·07	·06	·07	..	·04	·04	·04	·04	·04	·05	·03	·03	·06	·05	·05	·06	·06	·08	·05	·06
28	..	..	..	·04	·02	·01	·03	..	..	..	·01	·03	·03	·02	·01	·01	..	..	·02	..	..	..	·01	..
29	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	·01	..	..	..	..
30	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
31	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Total	3·34	2·80	3·09	2·75	2·68	2·58	2·82	2·22	2·15	1·89	2·03	2·09	2·25	2·54	2·24	2·35	2·55	2·43	2·46	2·16	2·35	2·67	2·25	2·25
From Jan.1	22·00	23·22	22·84	21·43	20·74	20·07	22·12	20·21	19·34	18·05	19·34	18·47	17·81	16·24	17·45	18·77	19·12	18·52	19·20	18·33	19·00	20·77	18·41	18·33

Daily Rainfall. August, 1890.

Day of Month	Keston (Heathfd.)	Keston (Tow. Fds.)	Orpington	Farningham Hill	Wilmington	Chislehurst	Bickley	Beckenham	Wimbledon (Sew. Wks.)	Wimbledon (Mt. Ararat)	Raynes Park	New Malden	Esher	Surbiton	Kingston	Richmond	Kew	Brixton	West Norwood	Sydenham	Forest Hill	Deptford	Greenwich	Eltham
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
2	·12	·13	·12	·11	·07	·13	·30	·18	·08	·08	·09	·05	·09	·05	·04	·06	·06	·08	·11	·13	·12	·08	·09	·14
3	·01	..	..	..	..	..	..	..	..	..	..	..	·01	..	·01	·01	·01	..	..	..	..	..	..	..
4	..	..	..	..	..	..	..	..	..	..	·01	·02	..	·01	..	·01	..	..	..	..	..	..	..	..
5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
7	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
8	·03	..	·01	·03	..	·02	·03	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	..	..
9	·46	·40	·31	·18	·19	·35	·39	·37	·26	·24	·24	·15	·20	·21	·24	·21	·23	·29	·34	·43	·37	·35	·36	·37
10	·20	·20	·17	·16	·20	·17	·16	·15	·28	·20	·25	·23	·15	·20	·15	·19	·19	·31	·19	·17	·18	·18	·19	·19
11	·08	·05	·05	·05	·02	·04	·07	·09	·03	·02	·05	·13	·02	·02	·01	·15	·01	·07	·08	·07	·08	·09	·06	·04
12	·02	·01	·01	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01
13	·01	..	..	·01	·01	..	·01	..	·02	·02	·02	..	..	..	..	·02	·01	·01	·03	·03	·03	..	·01	·05
14	·06	·03	·01	·02	..	·02	·01	·02	..	·01	·02	·01	·01	..	·01	·04	·07	·01	·01	·02	..	·01	·01	·03
15	·01	·01	..	·02	·02	·03	..	·04	·05	..	·08	·04	·05	·06	·05	·09	·04	·02	·12	·11	·15	·11	·13	·03
16	·04	..	·10	·06	·02	·01	·05	..	..	·05	·01	..	..	..	..	..	..	..	..	..	..	·01	·02	·02
17	·01	..	..	·01	·01	..	·01	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
18	·17	·20	·25	·19	·15	·26	·34	·39	·07	·03	·05	·04	·08	·06	·05	·05	·13	·04	·20	·30	·26	·28	·41	·28
19	·71	·80	·78	·76	·72	·71	·54	·43	·34	·55	·46	·54	·59	·43	·52	·62	·71	·67	·55	·55	·51	·49	·54	·54
20	·02	..	..	·04	·05	..	..	..	..	·01	·01	..	·01	..	..	..	..	..	..	..	..	..	..	·01
21	·02	..	·02	·01	·02	·02	·01	·02	·02	..	·02	..	·02	·01	..	·02	·04	·01	..	·02	..	..	·01	·03
22	..	..	..	..	..	..	..	..	..	..	..	..	·02	..	..	..	..	..	..	..	·03	..	..	..
23	·17	·08	·04	·02	·03	..	·06	·16	·02	·03	·05	..	·02	·06	..	·05	·09	·02	·10	·14	·08	·02	·04	·09
24	·14	·06	·11	·04	·04	·12	·13	·15	·36	·44	·27	·26	·20	·35	·46	·08	·02	·51	·21	·18	·15	·65	·44	·22
25	·10	·08	·08	·05	·10	·08	·12	·07	·06	·05	·04	·05	·08	·07	·60	·05	·06	·04	·03	·04	·03	·02	·03	·05
26	·15	·14	·13	·15	·26	·30	·30	·13	·09	·11	·11	·08	·12	·10	·10	·12	·12	·10	·11	·14	·13	·12	·15	·15
27	·07	·07	·09	·13	·03	·03	·03	·02	·02	..	·02	·01	·06	..	..	·14	·13	·01	·02	·02	·02	·02	·05	·01
28	·01	..	..	·03	..	·01	..	·01	·02	·01	·02	..	·02	·02	..	..	..	..	·09	·04	·08	·03	·02	·03
29	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
30	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	..	..
31	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	..	..
Total	2·62	2·26	2·28	2·08	1·95	2·30	2·56	2·23	1·73	1·85	1·82	1·61	1·75	1·65	2·24	1·91	1·95	2·19	2·19	2·39	2·22	2·46	2·54	2·29
From Jan. 1	20·31	19·04	17·50	17·25	15·78	17·14	19·14	17·11	16·59	16·97	17·28	13·81	14·16	15·56	18·40	17·79	17·54	18·53	18·60	19·63	17·36	17·07	17·77	17·96

Day of Month	Dorking	ReigateHill	Caterham	Marden Park	Kenley	Purley (Reedham)	Purley (Tudor C.)	Ashtead	Sutton	Carshalton	Wallington	Bedding-ton	Waddon	Croydon (Brim. Bn.)	Croydon (Limes Rd.)	Croydon (Whitgift)	Addiscmb. (Hvlk. Rd.)	Addiscmb. (Outm. Rd.)	Addington Hills	Addington (Park Fm.)	Addington (Pump. St.)	West Wickham	Hayes Common	Keston (Bradfield)
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
2	..	·05	..	·04	..	·02	·04	..	·03	·01	·02	·02	·02	·02	·01	·02	·02	·02	·03	·02	·03	·02	·01	·03
3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..
4	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·02	..	..	..	..	..
6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
7	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
9	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
11	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
13	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
14	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
15	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
16	..	·03	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
17	·21	·30	·29	·22	·25	·23	·25	·28	·30	·12	·17	·16	·13	·17	·14	·15	·13	·13	·16	·12	·16	·20	·25	·26
18	·02	·11	..	·16	·17	·15	·14	·05	·11	·14	·15	·15	·17	·16	·17	·16	·17	·16	·16	·15	·15	·14	·14	·11
19	·13	·10	·23	·06	·07	·07	·06	·10	·08	·04	·04	·05	·05	·06	·04	·05	·06	·06	·06	·05	·05	·17	·07	·07
20	..	·01	·03	·02	·02	·07	·05	·04	..	·01	·01	·01	·03	·02	·03	·03	·01	·01	·01	·01	·02	·01	·01	·01
21	·21	·31	·25	·16	·21	·17	·16	·15	·31	·14	·15	·15	·13	·14	·11	·12	·12	·11	·16	·15	·12	·13	·13	·10
22	·10	·01	..	..	..	..	·01	..	..	·01	·01	·02	·01	·01	·01	·03	·01	..	..	..	..	..	..	..
23	·12	·06	·05	·04	·06	·05	·05	..	·14	·07	·06	·05	·05	·05	·03	·04	·01	..	·02	·01	·02	·32	·04	·14
24	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
25	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
26	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
27	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	·01	..	..	..
28	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	..
29	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
30	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Total	·79	·98	·85	·70	·79	·76	·76	·62	·97	·54	·61	·61	·59	·63	·54	·61	·53	·50	·62	·52	·56	·99	·65	·72
From Jan. 1	22·79	24·20	23·69	22·13	21·53	20·83	22·88	20·83	20·31	18·59	19·95	19·08	18·40	16·87	17·99	19·38	19·65	19·02	19·82	18·85	19·56	21·76	19·06	19·05

Daily Rainfall. September, 1890.

Day of Month	Keston (Heathfld.)	Keston (Tow. Fds.)	Orpington	Farning-ham Hill	Wilming-ton	Chislehurst	Bickley	Beckenham	Wimbledon (Sew. Wks.)	Wimbledon (Mt. Ararat)	Raynes Park	New Malden	Esher	Surbiton	Kingston	Richmond	Kew	Brixton	West Norwood	Sydenham	Forest Hill	Deptford	Greenwich	Eltham
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
2	·03	..	..	·01	..	..	..	·01	·03	·02	·02	·02	·01	·01	·02	·03	·01	·01	·03	·03	·01	..	..	..
3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	..	..
4	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	..	..
6	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
7	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..
8	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	·01	..	·01	..	..	..	..	..	..	..
9	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..
10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
11	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	·01	..	..	..	..	..	..	..
13	..	..	..	·01	..	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..
14	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..
15	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	..	·01	..	..	..	..	..	..	..
16	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
17	·33	·27	·16	·13	·15	·20	·34	·22	·07	·27	·25	·18	·11	·27	·35	·20	·22	·10	·11	·23	·17	·16	·15	·19
18	·11	·13	·11	·03	·05	·11	·14	·15	·13	·09	·10	·06	·01	·03	·06	·05	·04	·16	·16	·17	·15	·11	·11	·09
19	·08	·08	·11	·18	·10	·09	·10	·05	..	·05	·06	·05	·04	·04	·04	·05	·05	·03	·04	·06	·01	·05	·07	·07
20	·02	·01	..	·04	·03	..	..	..	..	..	..	..	·04	..	..	·01	·04	..	..	·02	·05	..	..	..
21	·12	·10	·07	·01	·04	·11	·12	·09	·23	·24	·28	·04	·10	·08	·06	·04	·05	·04	·07	·10	·06	·06	·07	·10
22	..	..	..	..	..	..	..	..	·05	·01	·04	..	·02	..	·05	..	..	·05	..	..	..	..	..	..
23	·13	·11	·12	·13	·20	·05	·04	..	·59	·42	·36	·30	·15	·22	·60	·83	·12	·44	·24	·03	·01	·35	·25	·02
24	..	..	..	..	·01	..	..	..	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..
25	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
26	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
27	..	..	..	·01	·01	..	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..
28	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
29	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
30	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Total	·83	·70	·57	·55	·60	·56	·74	·52	1·10	1·14	1·14	·65	·49	·65	1·20	1·21	·58	·83	·65	·64	·46	·73	·65	·47
From Jan. 1	21·14	19·74	18·07	17·80	16·38	17·70	19·88	17·63	17·69	18·11	18·42	14·46	14·65	16·21	19·60	19·00	18·12	19·36	19·25	20·27	17·82	17·80	18·42	18·43

Daily Rainfall.

October, 1890.

Day of Month	Dorking	ReigateHill	Caterham	Marden Park	Kenley	Purley (Reedham)	Purley (Tudor C.)	Ashtead	Sutton	Carshalton	Wallington	Bedding-ton	Waddon	Croydon (Brim. Bn.)	Croydon (Limes Rd.)	Croydon (Whitgift)	Addiscmb. (Hvlk. Rd.)	Addiscmb. (Outm. Rd.)	Addington Hills	Addington (Park Fm.)	Addington (Pump. St.)	West Wickham	Hayes Common	Keston (Bradfield)
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·04	..	..	·01	·07	·07	·03	·05	·03	..	·02	·01	..	..	·01	..	..	..	·01	·02	·06	·03	..	·04
2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
4	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
6	·06	·04	·20	..	·05	·03	·05	·07	·06	·05	·04	·05	·04	·05	·05	·05	·05	·05	·04	..	·03	..	·04	·02
7	·19	·25	·15	·23	·19	·17	·16	·16	·14	·10	·13	·13	·15	·15	·15	·15	·15	·16	·18	·20	·18	·20	·12	·13
8	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
9	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
11	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..
12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..
13	..	..	..	·03	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
14	..	..	..	..	·02	..	·01	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	..	..
15	·25	·21	·18	·20	·25	·27	·30	·27	·25	·19	·25	·22	·21	·20	·19	·21	·20	·21	·30	·23	·28	·29	·26	·24
16	..	..	..	·01	·01	·01	..	..	·02	·01	..	·02	·02	·03	·01	..	·01	·01	·01	·01	·01	..	·01	·01
17	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
18	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
19	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
20	·05	·07	·08	·10	·08	·07	·09	·07	·07	·07	·07	·08	·08	·09	·09	·09	·09	·09	·10	·08	·08	·10	·09	·09
21	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·03	..	..	·01	·01
22	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
23	..	..	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
24	·10	·09	·05	·01	·08	·07	·06	·08	·07	·04	·06	·05	·05	·05	·06	·03	·05	·05	·06	·05	·06	·07	·05	·05
25	·40	·39	·47	·37	·37	·38	·38	·41	·36	·33	·34	·34	·32	·32	·30	·33	·33	·32	·36	·35	·35	·39	·32	·32
26	·04	·10	..	·09	·13	·12	·14	·14	·09	·07	·09	·08	·10	·10	·13	·11	·13	·11	·11	·15	·15	·13	·16	·16
27	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	·01	..
28	..	·02	·15	·01	·02	·02	·01	..	·02	..	·01	·01	·02	..	·01	..	·02	·01	·02	..	·01	..	·02	·02
29	·05	·04	·05	·05	·08	·05	·07	·05	·06	·05	·06	·06	·05	·06	·03	·04	·04	·04	·05	·06	·04	·03	·01	·02
30	·02	·04	·10	·03	·02	·03	·07	·03	..	·04	·01	·01	·02	·02	·01	·02	·02	·02	·01	·01	·01	·01	·01	·02
31	·11	·17	·07	·13	·14	·13	·10	·14	·08	·05	·08	·09	·08	·08	·07	·08	·08	·08	·08	·13	·15	·19	·13	·10
Total	1·31	1·43	1·50	1·27	1·53	1·42	1·48	1·47	1·25	1·01	1·16	1·15	1·14	1·15	1·11	1·11	1·18	1·15	1·33	1·37	1·41	1·44	1·26	1·23
From Jan. 1	24·10	25·63	25·19	23·40	23·06	22·25	24·36	22·30	21·56	19·60	21·11	20·23	19·54	18·02	19·10	20·49	20·83	20·17	21·15	20·22	20·97	23·20	20·32	20·28

Daily Rainfall.

October, 1890.

Day of Month	Keston (Heathfd.)	Keston (Tow. Fds.)	Orpington	Farningham Hill	Wilmington	Chislehurst	Bickley	Beckenham	Wimbledon (Sew. Wks.)	Wimbledon (Mt. Ararat)	Raynes Park	New Malden
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·04	·05	..	..	..	..	..	..	·01	..	·02	..
2	..	..	..	..	..	..	..	..	..	..	..	..
3	..	..	..	..	..	..	..	..	..	..	..	..
4	..	..	..	..	..	..	..	..	..	..	..	..
5	..	..	..	..	..	..	..	..	·01	·01	..	..
6	·05	..	·02	..	·05	·04	..	·03	·04	..	·06	·04
7	·13	·17	·13	·12	·12	·13	·18	·14	·15	·20	·15	·12
8	..	..	..	·01	..	..	..	..	..	..	·01	..
9	..	..	..	..	..	..	..	..	..	·01	..	..
10	..	..	..	·01	..	..	..	..	..	..	..	..
11	..	..	..	·01	..	..	..	..	..	·01	·02	..
12	..	..	..	..	..	..	..	..	..	·01	·02	..
13	..	..	..	·01	..	..	..	..	..	..	·01	..
14	..	..	..	..	·01	..	..	..	..	·01	·01	..
15	·27	·30	·26	·25	·18	·21	·19	·21	·24	·21	·19	·15
16	·01	..	·01	..	·01	·01	·02	·01	·02	·01	·02	..
17	..	..	..	..	·01	..	..	..	..	..	..	..
18	..	..	..	..	..	..	..	..	..	..	..	..
19	..	..	..	..	..	..	..	..	..	·24	..	..
20	·09	·10	·08	·05	·07	·09	·10	·08	·08	·07	·08	·05
21	..	..	..	..	..	..	..	..	..	..	·01	..
22	..	..	..	..	..	..	..	..	..	..	..	..
23	..	..	..	..	..	..	..	..	..	..	..	..
24	·06	·06	·06	·03	·03	·06	·08	·05	·06	·07	·06	..
25	·33	·32	·29	·30	·33	·33	·34	·32	·30	·34	·33	·30
26	·17	·15	·15	·08	·07	·11	·14	·09	·05	·05	·06	·05
27	·01	..	..	..	..	..	..	..	..	..	..	..
28	·02	·02	..	..	·01	·03	·03	·03	·02	·01	·03	..
29	·02	·01	·02	·01	·01	·02	·01	·01	·02	·06	·06	·03
30	·01	·01	..	·01	..	·02	·03	·01	·03	·03	·03	·03
31	·03	·08	·10	·10	·12	·08	·07	·07	·03	·02	·04	·04
Total	1·34	1·27	1·12	·99	1·02	1·13	1·19	1·05	1·06	1·36	1·21	·81
From Jan. 1	22·48	21·01	19·19	18·79	17·40	18·83	21·07	18·68	18·75	19·47	19·63	15·27

Day of Month	Esher	Surbiton	Kingston	Richmond	Kew	Brixton	West Norwood	Sydenham	Forest Hill	Deptford	Greenwich	Eltham
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·01	..	..	·05	·04	..	·02	·02	..	..	..	·03
2	..	..	..	..	..	..	..	..	..	..	..	..
3	..	..	..	..	..	..	..	..	..	..	..	..
4	..	..	..	..	..	..	..	..	..	..	..	..
5	..	..	..	·03	·01	·02	..	·01	..	·01	·01	..
6	..	·04	·07	·06	·06	·01	·04	·03	..	·07	·07	·06
7	·10	·12	·14	·14	·14	·29	·17	·20	..	·18	·23	·17
8	..	..	..	..	..	..	..	..	..	..	..	..
9	..	..	..	..	·01	..	..	..	..	..	..	..
10	..	..	..	..	..	..	..	..	..	..	..	..
11	..	..	..	..	·01	..	..	..	..	..	..	..
12	..	..	..	..	·01	..	..	·02	..	..	..	..
13	..	..	..	..	·01	..	..	..	..	..	..	..
14	..	..	..	·02	·02	..	..	..	..	..	..	..
15	·10	·18	·21	·16	·12	·21	·23	·24	·30	·18	·19	·25
16	..	..	..	·01	·01	·01	·02	·01	·01	..	·01	·02
17	..	..	..	..	..	..	..	..	..	..	..	..
18	..	..	..	..	..	..	..	..	..	..	..	..
19	..	..	..	..	..	..	..	..	..	..	..	..
20	·04	·05	·08	·06	·06	·08	·09	·09	·09	..	·10	·10
21	..	..	..	..	·01	·01	..	·01	..	..	..	..
22	..	..	..	..	·01	..	..	..	..	..	..	..
23	..	..	..	..	..	..	..	..	..	..	..	..
24	·06	·06	·06	·05	·05	·04	·04	·05	·02	·13	·04	·04
25	·27	·35	·35	·30	·29	·30	·31	·35	·32	·30	·31	·36
26	·07	·07	·06	·06	·06	·07	·07	·10	·08	·12	·13	·13
27	..	..	..	..	·01	..	..	..	..	..	..	..
28	..	..	·02	·02	·01	·02	·02	·03	..	·03	·03	·03
29	·01	·03	·04	·03	·02	·01	·01	·04	·03	·01	·01	·01
30	·01	·02	·02	·02	·01	·01	·02	·03	·02	·01	·01	·01
31	·04	·02	·02	·06	·06	·04	·02	·10	·06	·05	·05	·07
Total	·71	·94	1·07	1·07	1·03	1·12	1·06	1·33	·93	1·09	1·19	1·28
From Jan. 1	15·36	17·15	20·67	20·07	19·15	20·48	20·31	21·60	18·75	18·89	19·61	19·71

Daily Rainfall. November, 1890.

Day of Month	Dorking	Reigate Hill	Caterham	Marden Park	Kenley	Purley (Reedham)	Purley (Tudor C.)	Ashtead	Sutton	Carshalton	Wallington	Beddington	Waddon
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·25	·34	..	·24	·17	·15	·19	·15	·11	·10	·11	·12	·11
2	·07	·04	..	·20	·11	·08	·10	·08	·05	·03	·05	·06	·06
3	·12	·10	..	..	·10	·07	·06	·07	·06	·05	·06	·06	·06
4	·41	·04	·62	·25	·11	·10	·10	·26	·08	·07	·08	·07	·09
5	..	..	..	·01	..	..	·01	..	..	..	..	..	..
6	·67	·49	·50	·43	·60	·50	·59	·58	·55	·50	·53	·51	·49
7	·13	·19	·10	..	·11	·11	·11	·15	·09	·10	·10	·09	·08
8	·12	·13	·16	·10	·15	·12	..	·14	·15	·12	·14	·15	·11
9	..	·02	..	·07	·02	..	·01	..	..	..	·01	..	..
10	·15	·08	·15	·08	·10	·10	·09	·13	·08	·10	·05	·05	·05
11	·03	·04	..	·04	·08	·05	·07	·07	·07	..	·06	·05	·02
12	·38	·35	·34	·31	·40	·29	·34	·18	·21	·18	·22	·23	·21
13	..	·02	..	·01	·01	·01	·01	..	·01	·01	·01	..	..
14	·10	·11	·11	·07	·09	·05	·06	·10	·06	·04	·05	·06	·04
15	..	·01	..	..	·01	..	·01	..	·01	..	..	..	..
16	·02	·02	·02	·01	·02	·01	·02	·05	..	·01	·01	..	..
17	..	·01	..	·01	·01	·01	·01	..	..	..	·01	..	..
18	·03	·03	·04	..	·05	·05	·05	·04	·05	·04	·05	·03	·03
19	..	..	..	..	·01	..	·01	·03	..	·01	..	..	·01
20	..	..	..	·04	..	..	·01	..	..	..	..	..	..
21	·18	·17	·15	·12	·14	·13	·15	·11	·10	·08	·10	·12	·09
22	·06	·10	·10	·09	·10	·09	·08	·12	·10	·07	·08	·08	·08
23	·16	·16	·10	·02	·09	·09	..	·15	·09	·07	·09	·07	·07
24	·04	·01	..	·05	·02	·01	·01	·05	..	..	..	·02	·02
25	·02	..	·10	·10	·08	·07	·06	..	..	..	·02	·02	·03
26	..	..	..	·04	·01	·06	·03	..	..	..	..	·01	..
27	·09	·14	·10	·09	·12	·07	·02	·10	..	·07	·07	·04	·08
28	..	·05	·09	·02	·04	·03	·11	·07	·04	·02	·03	·05	·03
29	..	..	..	..	·01	..	·03	...	..	..	·01	..	..
30	..	..	..	..	..	..	..	..	..	..	..	..	..
Total	3·03	2·65	2·68	2·40	2·76	2·25	2·34	2·63	1·91	1·67	1·94	1·89	1·76
From Jan. 1	27·13	28·28	27·87	25·80	25·82	24·50	26·70	24·93	23·47	21·27	23·05	22·12	21·30

Day of Month	Croydon (Brim. Bn.)	Croydon (Limes Rd.)	Croydon (Whitgift)	Addiscmb. (Hvlk. Rd.)	Addiscmb. (Outm. Rd.)	Addington Hills	Addington (Park Fm.)	Addington (Pump. St.)	West Wickham	Hayes Common	Keston (Bradfield)
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·05	·10	·11	·11	·12	·16	·02	·15	·17	·15	·12
2	·06	·07	·05	·07	·06	·06	·17	·07	·10	·07	·07
3	·04	·04	·05	·05	·04	·06	·05	·05	·05	·05	·06
4	·09	·11	·11	·13	·13	·16	·17	·14	·34	·27	·32
5	..	..	..	..	..	..	..	..	·01	..	·01
6	·42	·47	·50	·51	·50	·48	·55	·51	·54	·50	·44
7	·08	·09	·10	·10	·09	·09	·11	·10	·09	·12	·12
8	·12	·10	·10	·12	·12	·10	..	·08	·09	..	·09
9	..	·01	..	·01	..	·02	·08	·04	·05	·03	·01
10	·04	·08	·04	·05	·05	·05	·05	·03	·05	·04	·03
11	·04	..	·07	·06	·03	·05	·06	·04	·01	·05	·04
12	·19	·20	·20	·18	·19	·22	·25	·24	·25	·19	·21
13	..	..	·01	·01	·01	·01	·01	·01	·01	·02	·01
14	·05	·04	·05	·05	·05	·05	·03	·07	·08	·07	·08
15	..	..	..	..	..	..	·02	..	·02	·01	..
16	..	·01	·01	..	·01	·01	·01	·01	·01	..	..
17	..	..	·01	·01	·01	..	..	..	..	·01	..
18	·04	·05	·04	·05	·04	·05	·05	·04	·05	·06	·06
19	..	·01	·01	·01	·01	·01	..	..	..	·01	..
20	..	..	·01	·01	..	..	·02	..	·01	..	..
21	·08	·05	·09	·07	·07	·08	·06	·08	·12	·07	·10
22	·08	·11	·09	·11	·10	·10	·02	·09	·12	·10	·08
23	·08	·06	·07	·06	·06	·08	·17	·09	·08	·07	·07
24	·03	·03	·03	·04	·04	·05	..	·05	·03	·04	·03
25	·04	·04	·03	·04	·04	·06	·02	·04	·09	·06	·09
26	·02	·01	·01	..	·01	·03	·09	·01	..	·02	·04
27	·08	·08	·14	·07	·08	·09	·01	·07	..	·09	·10
28	·06	·02	·09	·02	·04	·04	·05	·03	·19	·10	·04
29	..	·01	·01	·01	..	·01	·04	·01	·01	·02	·02
30	..	..	..	·01	..	..	..	..	..	·01	..
Total	1·69	1·79	2·03	1·96	1·90	2·12	2·11	2·05	2·57	2·23	2·24
From Jan. 1	19·71	20·89	22·52	22·79	22·07	23·27	22·33	23·02	25·77	22·55	22·52

Day of Month	Keston (Heathfd.)	Keston (Tow. Fds.)	Orpington	Farning-ham Hill	Wilming-ton	Chislehurst	Bickley	Beckenham	Wimbledon (Sew. Wks.)	Wimbledon (Mt. Ararat)	Raynes Park	New Malden	Esher	Surbiton	Kingston	Richmond	Kew	Brixton	West Norwood	Sydenham	Forest Hill	Deptford	Greenwich	Eltham
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·17	.12	·15	·15	·08	·18	·04	·09	·07	·08	·09	·09	·05	·08	·09	·17	·16	·07	·07	·05	·08	..	·08	·07
2	·08	·11	·06	·09	·11	·07	·14	·07	·06	·03	·05	..	·01	·03	·03	·02	·01	·10	·06	·02	·07	·12	·06	·08
3	·07	·06	·04	·06	·04	·05	·04	·04	·04	·04	·06	·04	·05	·05	·04	·06	·05	·04	·04	·03	·03	·05	·06	·05
4	·30	·30	·25	·25	·15	·30	·32	·17	·08	·11	·10	·09	·14	·16	·09	·07	·06	·12	·11	·14	·15	·16	·16	·32
5	·01	·01	·03	·01	·01	..	..	..	..	·01	..	..	·01	..	..	..	·01	..	..	..	..	..	..	..
6	·55	·51	·48	·33	·29	·40	·42	·39	·33	·33	·36	·19	·29	·34	·37	·37	·37	·32	·37	·38	·32	·28	·30	·31
7	·13	·13	·11	·15	·15	·13	·12	·12	·09	·10	·10	·08	·10	·09	·09	·10	·10	·08	·08	·11	·13	·10	·10	·13
8	·11	·10	·04	·03	·04	·05	·08	·06	·10	·11	·12	·06	·06	·06	·07	·07	·04	·08	·08	·09	·07	·03	·05	·06
9	·04	·02	..	·01	·01	·03	·04	·01	..	·01	·03	..	..	..	..	..	·01	..	..	..	..	·01	·02	·03
10	·04	·02	·05	·04	·04	·02	·02	·02	·03	·02	·04	·01	·05	·03	·05	·03	·01	·01	·02	·02	..	..	·01	·02
11	·04	·05	..	·02	·02	·03	·04	·03	..	·04	·05	..	·03	·03	..	·01	..	·01	·02	..	..	..	·01	·01
12	·26	·22	·21	·18	·10	·14	·12	·14	·17	·06	·16	·14	·10	·18	·21	·19	·19	·15	·14	·16	·16	·15	·14	·16
13	·01	..	..	·01	·02	..	..	·01	..	..	·01	..	..	..	..	..	·01	..	..	·03	..	..	..	..
14	·10	·10	·06	·04	·04	·06	·06	·05	·05	·05	·05	·04	·03	·06	·06	·06	·04	·06	·07	·05	·07	·05	·05	·08
15	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	..	..
16	·01	..	..	·01	..	..	·01	·01	·02	·01	·02	..	..	..	..	·01	·01	·01	·02	·02	·02	·01	·01	·02
17	·01	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01
18	·06	·07	·04	·03	·02	·05	·08	·04	·04	·04	·04	..	·02	·03	·04	·04	·04	·06	·07	·07	·03	·02	·04	·04
19	·01	..	..	..	·01	·01	·01	·01	..	..	·01	..	·01	..	..	..	..	..	·01	·01	..	..	..	·02
20	·01	..	..	..	·01	·01	..	..	..	·01	·01	..	..	..	..	..	..	..	..	..	·02	·01	..	..
21	·08	·08	·07	·06	·04	·06	·05	·05	·13	·10	·11	·09	·02	·08	·07	·09	·10	·06	·07	·05	·08	·09	·05	·15
22	·10	·10	·09	·05	·11	·10	·10	·10	·09	·09	·09	·06	·06	·12	·09	·09	·09	·09	·09	·11	·09	·09	·09	·12
23	·08	·08	·09	·10	·08	·09	·09	·13	·08	·07	·08	·05	·09	·08	·07	·10	·11	·12	·09	·17	·10	·08	·07	·01
24	·04	·02	..	·01	..	·02	·02	·01	..	..	..	..	·01	·01	..	..	·01	·03	·02	·03	·03	..	·01	·05
25	·11	·08	..	·07	·05	·03	·02	·02	..	..	·01	..	..	..	..	..	..	·01	..	·03	..	..	..	..
26	·03	·04	·10	·10	·02	·01	·05	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
27	·09	·22	·02	·18	·19	·12	·08	·09	·06	·13	·05	·10	·04	·16	·10	·07	·06	·04	·08	·12	·08	·09	·11	·25
28	·06	·08	..	·08	·02	·06	·05	·04	·05	..	·06	..	·03	·01	..	·05	·03	·06	·04	·02	·15	..	·05	·10
29	..	·01	..	..	..	·01	..	..	·01	..	·01	..	..	..	..	..	..	..	..	..	..	..	·01	..
30	..	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Total	2·60	2·53	1·89	2·06	1·67	2·04	2·00	1·70	1·50	1·44	1·71	1·04	1·20	1·60	1·47	1·60	1·52	1·52	1·55	1·71	1·68	1·34	1·48	2·09
From Jan. 1	25·08	23·54	21·08	20·85	19·07	20·87	23·07	20·38	20·25	20·91	21·34	16·31	16·56	18·75	22·14	21·67	20·67	22·00	21·86	23·31	20·43	20·23	21·09	21·80

Daily Rainfall. December, 1890.

Day of Month	Dorking	ReigateHill	Caterham	Marden Park	Kenley	Purley (Reedham)	Purley (Tudor C.)	Ashtead	Sutton	Carshalton	Wallington	Bedding-ton	Waddon	Croydon (Brim. Bn.)	Croydon (Limes Rd.)	Croydon (Whitgift)	Addiscomb. (Hvlk. Rd.)	Addiscomb. (Outm. Rd.)	Addington Hills	Addington (Park Fm.)	Addington (Pump. St.)	West Wickham	Hayes Common	Keston (Bradfield)
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	·01	..	..	..	..	·02	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
2	..	·02	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
3	·07	·09	·10	·06	·07	·05	·08	·06	·13	·05	·04	·05	·05	·05	·05	·04	·05	·06	·04	·05	·03	·03	·05	·05
4	·06	·09	·08	·08	·06	·08	·06	·10	·11	·07	·12	·12	·08	·12	·10	·10	·09	·08	·07	·08	·07	·09	·08	·09
5	..	·01	..	..	..	..	..	..	..	·01	..	..	..	..	..	..	·01	..	..	·01	..	..	·01	..
6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
7	..	..	..	·01	·01	..	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..
8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
9	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	..
10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
11	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
13	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
14	..	..	..	..	·01	..	..	..	..	·03	·01	..	..	..	..	·01	·01	·01	·01	..	·01	..	·01	..
15	·12	·08	·18	·10	·09	·13	·11	·18	·16	..	·03	·08	·08	·09	·07	·05	..	·05	·07	·07	·05	·10	·15	·08
16	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	·04	..	..	..	..	..	..	..
17	..	..	..	·01	·01	·01	..	..	..	..	·01	..	..	·02	..	·01	·01	·01	·01	..	..	..	..	·02
18	·18	·17	·14	·16	·17	·15	·12	·16	..	·15	·11	·13	·16	·08	·14	·18	·03	·18	·15	·08	·06	..	·01	·09
19	..	·07	·10	·07	·08	·09	·07	·15	·17	·16	·08	·09	·09	·10	·07	·11	·25	·09	·10	..	·06	·37	·11	·17
20	·30	·27	·15	·11	·21	·24	·20	·17	·20	·18	·23	·20	·21	·23	·19	·23	·24	·24	·22	·20	·21	·25	·28	·24
21	..	..	·03	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	..
22	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
23	..	..	·02	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	·01	..
24	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
25	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
26	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
27	..	..	..	..	·01	..	..	..	..	..	·01	·02	·02	..	·01	..	·02	·02	·02	·01	·01	..	·02	·03
28	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
29	..	..	..	..	·01	·03	·02	..	..	..	..	..	..	..	·01	·01	..	·01	..	·02	..	..	·08	·02
30	..	·10	..	·02	·04	·03	·04	·03	..	·03	·01	·08	·03	·04	·01	·03	·03	·04	·02	·04	·01	..	·02	·06
31	·08	·04	..	·03	·01	..	..	·05	·05	..	·02	·02	·01	..	·02	·01	·01	·01	·02	·01	·01	·37	·02	·02
Total	·81	·95	·80	·67	·79	·82	·72	·90	·82	·68	·71	·79	·73	·73	·67	·78	·79	·81	·73	·57	·54	1·21	·85	·87
From Jan. 1	27·94	29·23	28·67	26·47	26·61	25·32	27·42	25·83	24·29	21·95	23·76	22·91	22·03	20·44	21·56	23·30	23·58	22·88	24·00	22·90	23·56	26·98	23·40	23·39

Day of Month	Keston (Heathfd.)	Keston (Tow. Fds.)	Orpington	Farningham Hill	Wilmington	Chislehurst	Bickley	Beckenham	Wimbledon (Sew. Wks.	Wimbledon (Mt. Ararat)	Raynes Park
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	..	..	..	·02	..	..	..	..	..	..
2	..	..	..	..	..	..	..	..	..	..	..
3	·05	·05	·04	·03	·05	·04	·08	·03	·02	·04	·03
4	·08	·09	·09	·09	·08	·04	·05	·09	·06	·05	·05
5	..	..	..	..	·01	..	..	..	..	..	..
6	..	..	..	..	..	..	..	..	..	..	..
7	..	..	..	..	·01	..	..	..	..	..	..
8	..	..	..	..	·01	..	..	..	..	..	..
9	..	..	..	..	..	..	..	..	..	..	..
10	..	..	..	·01	..	..	..	..	..	..	..
11	..	..	..	·01	..	..	..	.	..	..	..
12	..	..	..	·01	..	..	..	..	..	..	..
13	..	..	..	..	..	..	..	..	..	..	..
14	..	..	..	..	..	·01	..	·01	·02	..	..
15	·09	·06	·06	·13	·07	·06	·15	·05	·07	..	·10
16	..	..	..	..	..	..	..	..	..	..	..
17	·01	..	..	·01	·17	·09	..	·01	·02	..	·02
18	·16	·18	·16	·15	·15	·16	·50	·14	·13	..	·10
19	·13	·15	·16	·09	·06	·09	·20	·08	·10	..	·09
20	·21	·28	·25	·32	·30	·27	·30	·21	·16	·35	·14
21	..	..	..	..	..	..	..	..	..	..	..
22	..	..	..	..	..	..	..	..	..	..	..
23	..	..	..	..	..	..	..	..	..	..	..
24	..	..	..	..	..	..	..	..	..	..	..
25	..	..	..	..	..	..	..	..	..	..	..
26	..	..	..	..	..	..	..	..	..	..	..
27	·03	·02	..	·02	·03	·03	..	·02	·03	..	·02
28	..	..	..	..	..	..	..	..	..	..	·01
29	·02	..	·01	·01	·02	·02	·03	..	..	..	·01
30	·05	·04	·01	·03	·01	..	·05	·01	·02	..	·02
31	·03	·02	..	·01	·05	..	..	·02	·01	·07	..
Total	·86	·89	·78	·92	1·04	·81	1·36	·67	·64	·51	·59
From Jan. 1	25·94	24·43	21·86	21·77	20·11	21·68	24·43	21·05	20·89	21·42	21·93

Day of Month	New Malden	Esher	Surbiton	Kingston	Richmond	Kew	Brixton	West Norwood	Sydenham	Forest Hill	Deptford	Greenwich	Eltham
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1			..	..	..	..	..	..	..	..	..	..	..
2			..	..	..	..	..	..	..	..	..	..	..
3			..	·05	·03	·02	·01	·03	·06	·04	·01	·02	·05
4			·06	·03	·05	·04	·08	·07	·07	·10	·06	·06	·10
5			..	..	..	..	..	..	..	..	..	..	..
6			..	..	..	..	..	..	..	..	..	..	..
7			..	..	..	..	..	..	..	..	..	..	..
8			..	..	..	..	..	..	..	..	..	..	..
9			..	..	..	..	..	..	..	..	..	..	..
10			..	..	..	..	..	..	·06	..	..	..	..
11			..	..	..	..	..	..	..	..	..	..	..
12			..	..	..	..	..	..	..	..	..	..	..
13			..	..	..	·01	..	..	..	..	..	..	..
14			..	·05	..	·04	·01	..	..	..	..	·01	..
15	Return unreliable.	Return unreliable.	·12	·11	·12	·04	·05	·07	·13	·08	·05	·04	·02
16			..	..	..	..	..	..	..	..	..	..	..
17			..	..	..	·01	·02	·01	..	·03	·02	·02	..
18			·14	·13	·11	·19	·16	·11	..	·04	·12	·17	·15
19			·09	·08	·15	·04	·18	·10	..	·07	·09	·00	·20
20			·22	·15	·18	·14	·18	·29	·48	·38	·20	·30	·35
21			..	..	..	..	..	..	..	..	..	..	..
22			..	..	..	..	..	..	..	..	..	..	..
23			..	..	..	..	..	..	..	..	..	..	..
24			..	..	..	..	..	..	..	..	..	..	..
25			..	..	..	..	..	..	..	..	..	..	..
26			..	..	..	..	..	..	..	..	..	..	..
27			..	..	·03	·01	·04	·02	·03	..	·02	·03	·01
28			..	..	..	..	..	..	..	..	..	..	..
29			..	..	..	..	..	..	..	..	..	·01	..
30			·03	..	·01	·01	·03	·03	..	..	·01	·01	·15
31			·04	..	..	..	·02	·02	..	·02	·02	·03	·05
Total			·70	·60	·68	·55	·78	·75	·83	·76	·60	·79	1·08
From Jan. 1			19·41	22·74	22·35	21·22	22·78	22·61	24·14	21·19	20·83	21·88	22·88

APPENDIX III.

MONTHLY RECORDS.

Station.	Jan.	Feb.	Mar.	Apr.	May	Jun.	July	Aug.	Sep.	Oct.	Nov.	Dec.	Year.
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
Knockholt..	3·80	1·05	3·20	1·70	1·64	2·53	4·45	2·17†	1·05	1·45	3·00	0·88	26·92
Sutton	2·29	0·94	1·83	1·71	1·63	3·31	4·46	2·00	0·82	1·11	1·70	0·84	22·64
S. Norwood.	2·30†	0·86†	2·14	1·92	1·51	2·61	3·92	2·19	0·57	0·99	1·71	0·61	21·33
Esher	2·38	0·97	1·51	1·74	1·76	2·65	3·07	1·93	0·50	1·10	1·79	0·70	20·10
Woolwich ..	2·15	1·30	1·94	1·87	1·50	2·40	3·78	2·23	0·39	1·77††	1·30	0·99	21·62

† Estimated. †† Taken November 5th.

APPENDIX IV.

Falls of 1·0 in. and upwards.

March 19th.

Reigate Hill, 1·01 in.; Farningham Hill, 1·10 in.

July 4th.

Dorking, 1·02 in.; Reigate Hill, 1·31 in.; Caterham, 1·25 in.; Marden Park, 1·25 in.; Kenley, 1·16 in.; Purley (Reedham), 1·14 in.; Purley (Tudor Cottages), 1·23 in.; Carshalton, 1·10 in.; Beddington, 1·01 in.; Croydon (Limes Road), 1·05 in.; Croydon (Whitgift), 1·05 in.; Addiscombe (Havelock Road), 1·01 in.; Addiscombe (Outram Road), 1·06 in.; Addington Hills, 1·13 in.; Addington (Pumping Station), 1·10 in.; West Wickham, 1·07 in.; Hayes Common, 1·18 in.; Keston (Bradfield), 1·08 in.; Keston (Heathfield), 1·20 in.; Keston (Tower Fields), 1·16 in.; Orpington, 1·18 in.; Farningham Hill, 1·10 in.; Wilmington, 1·03 in.; Chislehurst, 1·07 in.; Bickley, 1·50 in.; Beckenham, 1·04 in.; Sydenham, 1·12 in.; Forest Hill, 1·02 in.; Eltham, 1·03 in.

July 17th.

Dorking, 1·30 in.; Purley (Reedham), 1·07 in.; Purley (Tudor Cottages), 1·83 in.; Ashtead, 1·25 in.; Sutton, 1·35 in.; Carshalton, 1·24 in.; Wallington, 1·55 in.; Beddington, 1·38 in.; Waddon, 1·25 in.; Croydon (Brimstone Barn), 1·23 in.; Croydon (Whitgift), 1·10 in.; Addiscombe (Havelock Road), 1·03 in.; Addington Hills, 1·04 in.; West Wickham, 1·13 in.; Wilmington, 1·07 in.; Wimbledon (Sewerage Works), 1·42 in.; Wimbledon

(Mt. Ararat), 1·60 in.; Raynes Park, 1·53 in.; New Malden, 1·14 in.; Esher, 1·72 in.; Surbiton, 1·48 in.; Kingston, 2·62 in.; Richmond, 2·27 in.; Kew, 2·28 in.; Brixton, 1·79 in.; West Norwood, 2·47 in.; Sydenham, 1·70 in.; Forest Hill, 1·62 in.; Deptford, 1·82 in.; Greenwich, 1·62 in.

APPENDIX V.

January.

The month was very mild, damp, and stormy, with, however, an unusual number of fine days. The percentage of bright sunshine recorded at Kew was 21, being the highest January value yet registered, the mean percentage for the past 13 years being 14. At Beddington the maximum thermometer was above 50° on 16 days, and 45° on 25 days. The rainfall was slightly above the average.

February.

This month was bright, dry, and rather cool. The percentage of bright sunshine recorded at Kew was 21, the average value for the past 13 years being 19. At Beddington the maximum thermometer only once touched 50°. The rainfall was nearly 1 in. below the average.

March.

This month was characterised by a great variety of temperature, and a comparatively large rainfall. The temperature of the first four days was unusually low, that of the 4th being the coldest on record at Greenwich. The minimum thermometer in the shade at Beddington on this day stood at 5·4°, and at Wallington 9·8°. Vegetation towards the end of the month was considered to have been three weeks earlier than 1889, and five weeks earlier than 1888.

April.

The month has been cold, the rainfall about the average, and as a rule vegetation was rather backward. Easterly and north-easterly winds were prevalent. Butterflies were very late, and few in number; the nightingale was heard at Beddington on the 22nd, the cuckoo at Keston on the 14th, and swallows were seen at Keston on the 23rd.

May.

The month has been very mild and fine, with no cutting east winds or frosts. The maximum thermometer rated rather low,

being at Beddington over 70° on three days only. Strawberries and apples promised well, but plums and peaches were exceedingly scarce. Insects were few in number. The rainfall was rather low.

June.

The month was very cool and wet. The low daily maxima were remarkable; at Beddington the maximum thermometer was only twice above 76°, and only five times above 70°. The rainfall at Kew was the heaviest for June since 1879, and was 1·20 in. above the average for the past 30 years. At Kew, of the amount 0·96 in. on the 28th, no less than 0·45 in. fell in forty minutes, namely, between 8.40 and 9.20 p.m. The hay crop was generally good, and, as regards fruit, apples, currants, and strawberries were fairly plentiful, but there were no plums, pears, or peaches.

July.

This month may be divided into two portions, the first eighteen days being very wet, and the latter part of the month dry. It was the wettest July since 1888. At Kew, the fall on the 17th, 2·28 in., exceeds any previous record by 0·50 in.: it lasted from 5 p.m. on the 17th till 6 a.m. on the 18th, and of this fall 0.50 in. in thirty minutes, between 6.45 and 7.15, on the 17th. The maximum temperature was very low; at Beddington the maximum thermometer never touched 70° till the 15th, and the maximum, 75·2°, was on the 16th.

August.

This month has been cold, dull and wet, and of a very similar character to August, 1888. The maximum temperature of the month occurred on the 5th, and was at Wallington 81·9°.

September.

The month was very dry and warm, with a remarkably small rainfall. At Kew the rainfall was no less than 1·90 in. below the September mean for the past 30 years, and was the smallest fall since 1865. The mean temperature was much above the average.

October.

The first fifteen days of the month were warm, and the latter part much colder. At Kew 121½ hours of bright sunshine were registered, giving a mean percentage of 39, which was 10 per cent. above the average of the past 13 years, and was the highest October value recorded there. The rainfall of the month was extremely low, and was at Kew 1·50 in. below the average of the past 30 years, and the smallest October fall since 1879.

November.

The month was very mild, with temperature much above the average until the 25th, when a spell of cold set in. The low temperature of the 28th will long be remembered; it was 2·1° at Beddington, 1·0° at Waddon, and 10·3° at Wallington. The rainfall was rather small, and at Kew it was 0·75 in. below the average of the past 30 years.

December.

This was the coldest December for certainly 100 years. At Beddington the mean for the month was 28°, and the low daily maxima were as remarkable as the minima. There has been no month so cold since January, 1838, or perhaps February, 1855. At Beddington 23 days had the mean below 32°, and on 14 the maxima were below 32°; whilst the minima were below 20° on 12 days, 15° on 6 days, and 12° on 4 days. The absence of sun was most remarkable, only 20 minutes of bright sunshine being recorded at Kew during the whole month. The rainfall also was very small, the amount at Kew being 1·40 in. below the average of the past 30 years.

92.—Wandle Temperatures.

By Thomas Cushing, F.R. Met. S.

(Read February 11th, 1891.)

The question of the variations found in the temperature of the River Wandle is one which, I think, ought to have some interest for us, as it is of a purely local character; and it is on this account that I venture to draw attention to the great discrepancies which occur within a very limited area of this river, and will, with your permission, say a few words this evening by way of supplementing the Meteorological Sub-Committee's Report, which has just been read to us.

The observations from which my analysis has been made were taken every Sunday afternoon throughout the year 1889, by our indefatigable Hon. Secretary, Mr. Bayard, and the way in which he has tabulated the observations and worked out the means—if he will allow me to say so—does him the greatest possible credit. I believe he has taken them both before and after this period, but 1889 is the only complete year with which I have had the opportunity of dealing. I understand that all the observations were taken with the same thermometer, that the thermometer is graduated on the stem, and has been verified at Kew. The depths at which the observations were taken vary from 12 to 18 inches below the surface of the water.

In all there are ten stations on this river, within an area of one mile, five on the Carshalton branch and five on the Croydon branch. The Carshalton stations are at Park Wall, Phillpott's Corner and Haydon's Corner, at the Lower Pond steps, at the Upper Pond, Old Rectory Stream, and at Waterhouse Pool. And, on the Croydon branch, at the Road Well, Wallington Old Manor House, the mill-stream and pool-stream at Smee's Mill, and the road-stream and pool-stream at Wallington Manor House. Those are the stations at which the temperatures were systematically taken every Sunday throughout 1889.

The stations are numbered from 1 to 5 on the Carshalton branch, and from 6 to 10 on the Croydon branch.

1889.

Temperatures.—Carshalton Branch of Wandle.

				Greatest difference.
Station	1.	Lowest, 37·7°.	Dec. 29.	
		Highest, 58·3°.	Aug. 4.	20·6° Fahr.
,,	2.	Lowest, 45·1°.	Dec. 15.	
		Highest 54·9°.	Sept. 1.	9·8° ,,
,,	3.	Lowest, 49·9°.	Dec. 30.	
		Highest, 51·6°.	Aug. 4.	1·7° ,,

				Greatest difference.
Station	4. Lowest, 46·6°.	Jan. 6.		
	Highest, 55·0°.	June 2.	8·4°	Fahr.
"	5. Lowest, 49·8°.	Jan. 6.		
	Highest, 50·7°.	July 28.	0·9°	"

Croydon Branch.

"	6. Lowest, 48·3°.	April 4.		
	Highest. 52·6°.	Sept. 1.	4·3°	"
"	7. Lowest, 46·9°.	Jan. 6.		
	Highest, 53·4°.	June 2.	6·5°	"
"	8. Lowest, 41·6°.	Dec. 29.		
	Highest, 66·2°.	June 2.	24·6°	"
"	9. Lowest, 36·7°.	Jan. 6.		
	Highest, 63·0°.	June 2.	26·3°	"
"	10. Lowest, 48·5°.	Feb. 24.		
	Highest, 52·0°.	Sept. 1.	3·5°	"

1889.

The mean shade temperature of the air, *i. e.*, the weekly mean of the max. and min. for this period, was lowest on Jan. 6th, being 30·5° F.; the highest being 64·1° on Sept. 15th, showing a difference of 33·6°. But the lowest observed shade temperature I find was on Dec. 8th, being 25·3°, or 6·7° below the freezing-point; and the highest shade temperature, on June 30th, being 77·3°, or a difference of 52°.

Mr. Bayard has done good service in bringing these discrepancies to light, and placing them on record in the careful way he has, so that they may be available for future investigators.

DATE.	Wandle Temperatures. Carshalton Branch.										Wandle Temperatures. Croydon Branch.										Remarks for Week ending 9 p.m. on previous day.				
	Park Wall, Phillpott's Corner		Park Wall, Haydon's Corner		Lower Pond steps		Upper Pond, C. House stream		Waterhouse Pool		Wallington, O. M. House, Road well		Smee's Mill, Mill stream		Smee's Mill, Pool stream		Wallington, M. House, Road stream		Wallington, M. House, Pool stream		Mean Max. Temp. °	Mean Min. Temp. °	Mean Temp. °	Total Rain-fall IN.	Rainy days, ·01 & over NO.
	Temp. °	Time P.M.	Temp. °	Time P.M.	Temp. °	Time P.M.	Temp. °	Time P.M.	Temp. °	Time P.M.	Temp. °	Time P.M.	Temp. °	Time P.M.	Temp. °	Time P.M.	Temp. °	Time P.M.	Temp. °	Time P.M.					
1888																									
Nov. 4	50·3	3.10	51·0	3.15	50·6	3.23	49·9	3.30	50·3	3.35	50·9	3.50	50·5	4.0	50·7	4.5	49·5	4.10	50·9	4.15	54·3	46·9	50·6	2·55	6
„ 11	49·8	3.7	50·8	3.13	50·5	3.18	49·7	3.27	50·2	3.33	50·8	3.49	50·1	3.57	50·0	4.2	48·0	4.7	50·9	4.11	47·3	37·2	42·2	·48	4
„ 18	49·0	3.5	50·2	3.15	50·4	3.20	49·7	3.25	50·2	3.30	50·8	3·50	50·1	3.58	49·8	4.2	49·0	4.5	50·8	4.10	54·9	47·0	50·9	·49	3
„ 25*	50·5	3.6	50·7	3.12	50·5	3.17	50·1	3.23	50·3	3.30	50·9	3.47	50·6	3.55	51·0	3.59	50·0	4.3	50·8	4.7	53·2	45·4	49·3	·22	2
Mean	49·9	3.7	50·7	3.14	50·5	3.19	49·8	3.26	50·2	3.32	50·8	3.49	50·3	3.57	50·4	4.2	49·1	4.6	50·8	4.11	52·4	44·1	48·2	3·74	15
Dec. 2	49·1	3.5	50·1	3.10	50·5	3.16	49·3	3.23	50·2	3.30	50·7	3.46	50·1	3.56	49·1	3.59	47·0	4.3	50·3	4.13	50·5	42·8	46·6	1·76	6
„ 9	47·9	3.5	49·3	3.12	50·1	3.18	48·9	3.25	50·1	3.31	50·6	3.52	49·3	4.1	47·1	4.5	44·8	4.9	49·8	4.11	53·6	44·1	48·8	·26	5
„ 16	47·2	3.6	48·9	3.13	50·0	3.19	48·0	3.25	49·9	3.31	50·1	3.45	48·8	3.54	46·1	3.58	42·0	4.3	49·8	4.6	38·3	27·4	32·8	·05	5
„ 23	47·7	3.5	49·8	3.12	50·2	3.17	48·7	3.24	50·1	3.30	50·1	3.46	48·9	3.55	47·1	3.58	45·5	4.2	49·9	4.5	43·1	36·0	39·5	·44	4
„ 30	46·0	3.12	48·3	3.18	49·9	3.23	47·7	3.29	50·0	3.35	50·0	3.50	48·7	3.58	43·9	4.1	41·9	4.5	49·0	4.8	47·2	36·8	42·0	1·03	6
Mean	47·6	3.7	49·3	3.13	50·1	3.19	48·5	3.25	50·1	3.31	50·3	3.48	49·2	3.57	46·7	4.0	44·2	4.4	49·8	4.8	46·5	37·4	41·9	3·54	26
1889																									
Jan. 6	44·9	3.20	47·1	3.24	49·9	3.29	46·6	3.34	49·8	3.39	49·7	3.52	46·9	3.59	42·7	4.3	36·7	4.7	48·8	4.10	34·2	26·9	30·5	·03	1
„ 13	47·5	3·13	48·8	3.18	50·0	3.23	47·7	3.29	49·9	3.34	49·7	3.48	48·7	3.55	44·5	3.59	40·5	4.2	49·1	4.6	40·1	30·7	35·4	·77	5
„ 20	48·1	3.21	49·6	3 28	50·0	3.38	48·3	3.39	50·0	3.44	49·7	3.58	48·9	4.5	46·5	4.8	42·9	4.16	49·4	4.20	41·5	33·6	37·5	..	0
„ 27	48·5	3.7	49·7	3.13	50·1	3.18	48·0	3.24	50·0	3.29	49·4	3.45	48·9	3·52	45·3	3.56	42·3	4.0	49·1	4.4	42·5	34·6	38·5	·22	3
Mean	47·2	3.15	48·8	3·21	50·0	3.26	47·6	3.31	49·9	3.36	49·6	3.51	48·3	3.58	44·7	4.1	40·6	4.6	49·1	4.10	39·6	31·4	35·5	1·02	9
Feb. 3	46·3	3.24	49·1	3.30	50·0	3.35	47·6	3.40	50·0	3.46	49·2	3.59	47·7	4.6	44·7	4.10	42·2	4.14	49·0	4.19	49·7	37·2	43·4	·23	4
„ 10†	*48·5*	*3.18*	*50·1*	*3.24*	*50·3*	*3.29*	*48·4*	*3.35*	*50·0*	*3.41*	*49·1*	*3.55*	*48·4*	*4.2*	*47·0*	*4.6*	*44·4*	*4.12*	*49·4*	*4.16*	41·5	30·0	35·7	·73	6
„ 17	50·8	3.12	51·1	3.18	50·6	3.23	49·3	3.29	50·1	3.35	49·0	3.50	49·1	3.57	49·4	4.1	46·7	4.9	49·9	4.12	40·7	26·6	33·6	1·19	5
„ 24‡	47·7	3·17	49·0	3.22	49·9	3.28	48·1	3.34	49·8	3.47	48·7	4.1	48·4	4.8	44·3	4.11	40·5	4.15	48·5	4.18	46·9	36·9	41·9	·10	3
Mean	48·3	3.18	49·8	3.23	50·2	3.29	48·3	3.34	50·0	3.42	49·0	3.56	48·4	4.3	46·3	4.7	43·4	4.12	49·2	4.16	44·7	32·7	38·6	2·25	18
Mar. 3§	47·9	1.0	49·9	1.5	50·1	1.9	48·2	1.15	50·0	1.20	48·6	1.32	48·1	1.38	45·3	1.41	40·1	1.45	48·8	1.47	36·2	29·9	33·0	·16	5
„ 10	49·0	3.15	49·8	3.20	50·1	3.24	49·0	3.29	49·9	3.35	48·6	3.51	48·9	3.58	47·0	4.1	43·8	4.5	48·9	4.8	44·6	29·2	36·9	1·11	4
„ 17	50·5	3.12	50·7	3.17	50·2	3.22	49·7	3.27	50·1	3.34	48·6	3.48	49·2	3.56	49·8	4.0	46·6	4.3	49·5	4.6	45·9	31·8	38·8	·03	1
„ 24	51·7	3.13	51·1	3.19	50·5	3.23	50·3	3.29	50·1	3.34	48·6	3.50	49·9	3.57	51·8	4.1	48·8	4.5	49·9	4.8	49·2	36·8	43·0	·90	4
„ 31	50·8	3·23	50·7	3.28	50·2	3.32	50·1	3.38	50·1	3.42	48·6	3.56	49·9	4.2	50·9	4.6	48·9	4.9	49·2	4.13	53·3	39·1	46·2	·28	4
Mean	50·0	2·49	50·4	2.54	50·2	2.58	49·5	3.4	50·0	3.9	48·6	3.23	49·2	3.30	49·0	3.34	45·6	3.37	49·3	3.40	4·58	33·4	39·6	2·48	18

* Water rather low. † Snowing all afternoon, from 12.30 p.m.; river temperatures interpolated. ‡ Slight snow; more water.
§ Slight snow, most days.

DATE.	Wandle Temperatures. Carshalton Branch. Park Wall, Phillpott's Corner		Park Wall, Haydon's Corner		Lower Pond steps		Upper Pond, C. House stream		Waterhouse Pool		Wandle Temperatures. Croydon Branch. Wallington, O. M. House, Road well		Smee's Mill, Mill stream		Smee's Mill, Pool stream		Wallington, M. House, Road stream		Wallington, M. House, Pool stream		Remarks for Week ending 9 p.m. on previous day. Mean Max. Temp. °	Mean Min. Temp. °	Mean Temp. °	Total Rain-fall IN.	Rainy days, ·01 & over NO.
	Temp. °	Time P.M.	Temp. °	Time P.M.	Temp. °	Time P.M.	Temp. °	Time P.M.	Temp. °	Time P.M.	Temp. °	Time P.M.	Temp. °	Time P.M.	Temp. °	Time P.M.	Temp. °	Time P.M.	Temp. °	Time P.M.					
1889																									
April 7	51·9	3.19	50·9	3.24	50·4	3.29	50·7	3.35	50·1	3.40	48·6	3.55	50·1	4.3	53·1	4.6	50·1	4.10	49·8	4.13	51·6	37·5	44·5	·29	5
,, 14	48·9	3.32	49·7	3.37	50·1	3.48	49·1	3.47	50·0	3.52	48·3	4.5	48·7	4.12	47·1	4.15	44·7	4.18	48·6	4.21	49·6	38·9	44·2	1·06	7
,, 21	51·3	3.23	50·8	3.29	50·3	3.34	50·5	3.42	50·1	3.47	48·7	4.2	50·0	4.9	52·0	4.13	51·3	4.17	49·6	4.21	53·9	39·6	46·7	·03	1
,, 28	53·3	3.50	51·7	3.57	50·7	4.2	51·2	4.8	50·2	4.13	48·7	4.28	50·8	4.35	54·9	4.38	*52·8	4.45	50·1	4.49	55·2	39·9	47·5	·59	6
Mean	51·3	3.31	50·8	3.37	50·4	3.43	50·4	3.48	50·1	3.53	48·6	4.7	49·9	4.15	51·8	4.18	49·7	4.22	49·5	4.26	52·6	39·0	45·7	1·97	19
May 5	55·6	3.37	52·9	3.43	50·8	3.47	52·2	3.52	50·2	3.58	48·9	4.13	51·9	4.20	60·4	4.23	†59·7	4.30	50·1	4.33	59·8	42·4	51·1	·41	5
,, 12	50·7	3.21	50·6	3.27	50·2	3.32	50·5	3.37	50·2	3.43	49·0	3.57	49·8	4.4	50·5	4.8	50·8	4.12	49·3	4.16	66·9	48·8	57·8	·50	2
,, 19	52·1	3.20	51·4	3.25	50·6	3.30	51·1	3.36	50·3	3.41	49·3	3.54	50·8	4.1	54·9	4.5	53·0	4.9	49·8	4.12	63·3	46·6	54·9	·13	1
,, 26	51·8	3.15	51·1	3.21	50·5	3.26	51·2	3.32	50·4	3.38	49·7	3.59	50·5	4.7	53·9	4.10	55·2	4.14	49·7	4.17	72·5	50·7	61·6	·74	2
Mean	52·5	3.23	51·5	3.29	50·5	3.34	51·2	3.39	50·3	3.45	49·2	4.1	50·7	4.8	54·9	4.11	54·7	4.16	49·7	4.19	65·6	47·1	56·3	1·78	10
June 2	57·1	3.20	54·0	3.26	51·1	3.31	55·0	3.37	50·5	3.43	50·1	3.58	53·4	4.6	66·2	4.9	63·0	4.12	51·7	4.15	62·8	48·6	55·7	1·48	4
,, 9	51·7	3.23	50·8	3.28	50·5	3.33	51·1	3.38	50·3	3.45	50·0	4.2	50·3	4.9	53·7	4.12	54·5	4.16	49·9	4.19	75·5	54·4	64·9	·04	2
,, 16	54·9	2.54	53·3	3.0	51·1	3.5	53·8	3.12	50·6	3.19	50·9	3.42	51·6	3.50	61·8	3.54	57·6	3.58	50·9	4.2	62·9	51·9	57·4	1·14	4
,, 23	52·7	3.32	51·7	3.41	50·7	3.45	51·9	3.50	50·6	3.56	50·9	4.11	51·2	4.18	55·9	4.21	55·3	4.25	50·6	4.28	72·0	50·5	61·2	..	..
,, 30	56·9	3.6	54·3	3.12	51·5	3.16	54·6	3.23	50·6	3.29	51·7	3.45	51·9	3.55	63·7	3.58	59·0	4.1	51·2	4.4	77·3	51·6	64·4	·04	1
Mean	54·7	3.15	52·8	3.21	51·0	3.26	53·3	3.32	50·5	3.38	50·7	3.56	51·7	4.4	60·3	4.7	57·9	4.10	50·9	4.14	70·1	51·4	60·7	2·70	11
July 7	56·5	3.18	53·7	3.24	51·2	3.29	54·1	3.35	50·6	3·42	51·8	3.58	51·7	4.6	60·1	4.9	57·9	4.12	51·2	4.15	73·3	53·7	63·5	..	..
,, 14	53·8	3.17	52·3	3.22	50·9	3.26	53·0	3.32	50·6	3·37	51·9	3.51	51·6	3.58	58·0	4.1	57·1	4.5	51·0	4.8	70·3	57·2	63·7	·71	5
,, 21‡	*55·4*	*3.20*	*53·1*	*3.25*	*51·0*	*3.30*	*53·5*	*3.36*	*50·6*	*3·41*	*51·9*	*3.57*	*52·1*	*4·4*	*59·1*	*4.7*	*57·0*	*4.11*	*51·3*	*4.14*	67·5	52·1	59·8	1·06	4
,, 28	57·1	3.23	53·9	3.29	51·1	3.34	54·0	3.40	50·7	3.45	51·9	4.2	52·7	4.11	60·3	4.14	56·9	4.17	51·7	4.20	65·9	51·8	58·8	1·47	5
Mean	55·7	3.19	53·2	3.25	51·0	3.30	53·6	3.36	50·6	4.41	51·9	3.57	52·0	4.5	59·4	4.8	57·2	4.11	51·3	4.14	69·2	53·7	61·4	3·24	14
Aug. 4	58·3	3.10	54·3	3.16	51·6	3.21	54·0	3.27	50·6	3.34	51·9	3.51	52·7	3.59	60·9	4.2	59·1	4.6	51·8	4.9	75·2	55·7	60·4	·21	2
,, 11	54·7	3.2	53·8	3.8	51·2	3.13	52·5	3.19	50·6	3.25	52·1	3.44	51·7	3.51	57·6	3.54	55·9	3.58	51·6	4.1	69·3	52·7	61·0	·38	5
,, 18	55·8	3.18	54·5	3.24	51·1	3.29	53·3	3.35	50·6	3.42	52·2	4.0	52·2	4.10	59·4	4.12	57·7	4.15	51·8	4.18	67·0	53·5	60·2	·27	4
,, 25	54·7	3.6	53·9	3.12	51·0	3.17	52·2	3.22	50·6	3.28	52·0	3.47	52·7	3.55	57·8	3.58	54·9	4.2	51·6	4.6	66·1	51·7	58·9	1·01	5
Mean	55·9	3.9	54·4	3.15	51·2	3.20	53·0	3.26	50·6	3.32	52·0	3.50	52·3	3.59	58·9	4.1	56·9	4.5	51·7	4.8	69·4	53·4	60·1	1·87	16

* This spring was very slimy on surface. † Spring covered with thick green slime. ‡ Raining; river temperatures interpolated.

DATE.	Wandle Temperatures. Carshalton Branch.										Wandle Temperatures. Croydon Branch.										Remarks for Week ending 9 p.m. on previous day.				
	Park Wall, Phillpott's Corner		Park Wall, Haydon's Corner		Lower Pond steps		Upper Pond, C. House stream		Waterhouse Pool		Wallington, O. M. House, Road well		Smee's Mill, Mill stream		Smee's Mill, Pool stream		Wallington, M. House, Road stream		Wallington, M. House, Pool stream		Mean Max. Temp. °	Mean Min. Temp. °	Mean Temp. °	Total Rain-fall IN.	Rainy days, ·01 & over NO.
	Temp. °	Time P.M.	Temp. °	Time P.M.	Temp. °	Time P.M.	Temp. °	Time P.M.	Temp. °	Time P.M.	Temp. °	Time P.M.	Temp. °	Time P.M.	Temp. °	Time P.M.	Temp. °	Time P.M.	Temp. °	Time P.M.					
1889 Sept. 1	55·7	3.8	54·9	3.13	51·2	3.17	53·2	3.24	50·6	3.31	52·6	3.47	52·1	3.56	59·2	3.59	57·1	4.2	52·0	4.5	70·3	47·6	58·9	·01	1
" 8	53·3	3.15	52·6	3.21	50·8	3.25	52·2	3.30	50·7	3.35	52·1	3.50	51·5	3.57	55·3	4.0	54·7	4.4	51·7	4.7	70·0	57·0	63·5	·08	3
" 15*	53·0	3.10	52·1	3.17	50·7	3.22	51·9	3.28	50·6	3.34	52·1	3.50	51·5	3.58	54·9	4.1	54·8	4.4	51·6	4.7	74·5	53·8	64·1	..	..
" 22†	51·0	2.53	51·8	2.58	50·7	3.4	50·7	3.11	50·5	3.16	51·8	4.3	50·8	4.14	52·6	4.17	51·0	4.20	51·3	4.23	61·6	41·5	51·5	·17	3
" 29‡	50·0	3.2	50·8	3.8	50·6	3.14	50·5	3.19	50·3	3.25	51·6	3.39	50·7	3.46	51·2	3.49	51·0	3.52	51·1	3.55	59·1	43·2	51·1	·69	3
Mean	52·6	3.6	52·4	3.11	50·8	3.16	51·7	3.22	50·5	3.28	52·0	3.50	51·3	3.58	54·6	4.1	53·7	4.4	51·5	4.7	67·1	48·6	57·8	·95	10
Oct. 6‡	51·9	3.8	51·9	3.14	50·8	3.20	50·9	3.26	50·6	3.33	51·7	3.48	51·0	3.58	52·7	4.0	51·3	4.4	51·8	4.7	55·3	43·9	49·6	·85	7
" 13	50·7	3.16	52·5	3.22	50·8	3.27	50·3	3.33	50·2	3.39	51·2	3.54	50·7	4.1	51·2	4.4	49·7	4.8	51·3	4.10	57·6	44·3	50·9	·74	5
" 20	50·1	3.7	51·2	3.13	50·7	3.19	50·6	3.28	50·3	3.35	51·6	3.44	50·8	3.58	51·3	4.1	50·2	4.4	51·3	4.7	58·6	41·6	50·1	1·54	5
" 27§	48·8	3.12	50·1	3.19	50·6	3.25	49·9	3.31	50·3	3.38	51·3	3.53	50·4	4.1	49·2	4.5	49·3	4.8	51·2	4.11	52·2	41·7	46·9	·79	7
Mean	50·4	3.11	51·4	3.17	50·7	3.23	50·4	3.30	50·4	3.36	51·5	3.50	50·7	4.0	51·1	4.3	50·1	4.6	51·4	4.9	55·9	42·9	49·4	3·92	24
Nov. 3‖	*49·3*	*3.17*	*50·5*	*3.24*	*50·6*	*3.29*	*50·0*	*3.36*	*50·3*	*3.42*	*51·2*	*3.59*	*50·5*	*4.6*	*50·1*	*4.10*	*49·4*	*4.13*	*51·2*	*4.16*	54·7	42·4	48·5	·64	5
" 10	49·9	3.23	50·9	3.29	50·6	3.34	50·2	3.41	50·2	3.47	51·1	4.5	50·7	4.12	51·0	4.15	49·6	4.18	51·1	4.21	53·5	40·8	47·6	·23	2
" 17	50·5	3.10	50·7	3.16	50·6	3.21	50·5	3.28	50·3	3.39	51·1	3.52	50·9	4.1	51·5	4.4	50·0	4.8	51·1	4.11	53·7	40·2	46·9	·02	2
" 24‖	*45·6*	*3.10*	*49·0*	*3.16*	*50·3*	*3.21*	*48·8*	*3.28*	*50·1*	*3.36*	*50·5*	*3.50*	*49·7*	*3.57*	*47·3*	*4.0*	*44·8*	*4.3*	*50·3*	*4.5*	48·5	41·7	45·1	·18	2
Mean	48·8	3.15	50·3	3.21	50·5	3.26	49·9	3.33	50·2	3.41	51·0	3.57	50·5	4.4	50·0	4.7	48·5	4.11	50·9	4.13	52·6	41·3	47·0	1·07	11
Dec. 1	40·7	3.9	47·2	3.15	50·0	3.20	47·1	3.27	49·9	3.33	49·9	3.47	48·5	3.53	43·1	3.56	39·7	3.59	49·6	4.2	43·2	32·9	38·0	·39	2
" 8¶	37·8	3.7	47·2	3.14	50·1	3.18	47·7	3.24	49·9	3.29	49·6	3.42	48·9	3.50	45·1	3.53	40·5	3.56	49·7	3.59	36·4	25·3	30·8	·25	4
" 15	a39·7	3.9	a45·1	3.20	50·1	3.25	48·3	3.30	50·0	3.39	49·8	3.54	49·1	4.2	46·6	4.5	42·6	4.8	50·0	4.11	43·5	32·3	37·9	·29	5
" 22‖	*38·7*	*3.10*	*45·5*	*3.20*	*50·0*	*3.25*	*47·6*	*3.30*	*50·0*	*3.38*	*49·7*	*4.2*	*48·5*	*4.9*	*44·1*	*4.12*	*40·3*	*4.16*	*49·4*	*4.19*	48·1	38·7	43·4	·43	6
" 29	37·7	3.12	45·9	3.19	49·9	3.24	46·8	3.30	50·0	3.36	49·6	4.11	47·9	4.17	41·6	4.20	38·0	4.24	48·8	4.27	44·9	35·9	40·4	·46	4
Mean	38·9	3.9	46·2	3.18	50·0	3.22	47·5	3.28	50·0	3.35	49·7	3.55	48·6	4.2	44·1	4.5	40·2	4.9	49·5	4.12	43·2	33·0	38·1	1·82	21
1890 Jan. 5	46·7	3.16	48·6	3.21	50·2	3.25	49·0	3.33	50·1	3.39	49·7	3.52	49·3	4.0	47·8	4.3	44·8	4.6	49·9	4.9	36·4	27·8	32·1	·30	4
" 12	b44·8	3.1	b48·0	3.7	50·2	3.12	49·1	3.18	50·1	3.23	49·8	3.30	50·0	3.46	48·8	3.48	b46·7	3.52	49·8	3.55	52·2	43·1	47·6	·49	5
" 19	45·0	3.7	47·9	3.13	50·1	3.19	48·9	3.25	50·0	3.30	49·7	3.44	49·7	3.51	47·6	3.55	46·0	3.58	49·2	4.1	50·3	40·5	45·4	·36	4
" 26	45·1	3.11	48·9	3.16	50·1	3.21	48·3	3.26	49·9	3.32	49·7	3.45	49·0	3.52	46·0	3.55	45·7	3.58	49·4	4.1	48·6	38·1	43·3	·90	6
Mean	45·4	3.9	48·3	3.14	50·1	3.19	48·8	3.25	50·0	3.31	49·7	3.43	49·5	3.52	47·5	3.55	45·8	3.58	49·6	4.1	46·9	37·4	42·1	2·05	19

* Water low at Car B., 1st station.
‡ Water slightly lower at Car B., 1st station.
‖ Raining; river temperatures interpolated.
† Water lower at Car B., 1st station; and also Croydon B., 4th station.
§ Car B., 1st station, much lower; Car B., 4th station, higher.
¶ Snow on 7th.
a Water very low indeed.
b Water very low.

CONTENTS.

PROCEEDINGS.

Croydon Microscopical and Natural History Club.

OFFICERS FOR 1891.

Pictorial Selection in Photography.

By W. G. D.

Pictorial Selection in Photography.

[Photographic Section of the Croydon Microscopical Society.]

In dealing with the composition of pictures in reference to photography, apart from painting, it is only necessary to treat of: the position and arrangement of lines; the balance of parts; the variation in the tones of light and shade; and the most suitable positions for the introduction of figures or other objects which shall go to form a pleasing picture.

Let me, however, at the outset, explain that it is farthest from my wish to insist exclusively on any one series of rules upon which all pictures should be constructed, any more than I would desire to enforce a standard by which all works should be judged whether they be good or bad. I mean that, having regard to the great difference of opinion held on matters of art, it is useless to lay down an inflexible or hard-and-fast line which admits of no departure. I hope, therefore, the remarks I may make will be accepted rather in the light of "hints," in the carrying out of which a better result may be obtained than would otherwise occur should these points be overlooked or neglected.

Seeing that photography is so purely a mechanical process in which the artist has no chance of leaving out any objectionable object which may detract from the view before his lens, it is of the utmost importance he should know some of the principles on which a good picture is built up, in order that he may in some measure be able to cope with the difficulty and perhaps overcome it. To know where and how to select the best standpoint, how much of the prospect to include in his picture—and, of equal importance, how much he should *ex*-clude—to note the changes under varying lights, the relief of those portions in light against others in shade or cast shadow, the judicious arrangement of parts, or the apt introduction of figures requires more training than the setting up of a camera, the snapping of a shutter, and the subsequent development of

a plate; yet it is only on acquiring such knowledge that the photographer is able to excel, or that really artistic pictures can be produced.

To some these matters present little difficulty, they grasp or overcome them without apparent effort, in some instances are hardly conscious of having exercised any discrimination in their choice, and, if questioned on the composition of their pictures, could only tell you "they liked them that way best." Others are not so happy; they never get successful pictures—their horizon is too high or else it is too low, sometimes too dense, at others hard to find; the front elevation of a house appears to afford them interest; whilst a large tree in the centre, with a smaller one equidistant on either side, seems to them quite an ideal picture, the embodiment of perfection in composition—having a due regard to the equal balance of parts. Sometimes they essay figures or portraits (?) of their friends, and, remembering the triangular form has been, by some, greatly extolled, they straightway place their central figure in a standing position, carefully arranging the residue of their victims in sloping order, on either side, with a result too dreadful to dwell upon.

One could multiply these instances, but enough has been said to show how necessary it is to have either some knowledge of pictorial effect, or, failing this, the desirability of becoming acquainted with a few of the rules of art.

Composition is the art of properly disposing or arranging in the most effective manner the various forms and objects which constitute a picture, or, in other words, the judicious selection and combination of various parts which, when united, form one perfect whole. Sir Joshua Reynolds, when speaking of painting, says: "Composition, taken generally, is the principal part of invention, and is by far the greatest difficulty the artist has to encounter. Every man that can paint at all can execute individual parts; but to keep those parts in a due subordination, as relative to a whole, requires a comprehensive view of the art, that more strongly implies genius than perhaps any other quality whatever." Let us now see of what this quality consists; and, in the first place, consider the arrangement of lines.

Lines.

The term "line" is not altogether satisfactory, as there are no actual lines in nature, but it must in this instance be understood to refer to the apparent boundary of different objects, the limit at which they seem to merge the one into the other. The most important line, or that which has the greatest influence on all the others in a picture, is known as the horizon, or "horizontal line," which should always indicate the height of the eye of the spectator. This line varies in height with the position chosen, so that, when standing on a common or the seashore, the horizon appears low, but in ascending a cliff or hill it is found to rise in proportion to the height attained; hence, in the former case of the seashore, the horizon would be situated about a third or a fourth of the height of the picture above the base line, whilst in the latter instance it would be much nearer the top. It should not on any account be allowed to divide a picture exactly in the middle, as in this case all lines receding from the

spectator, either from above or beneath, would be too equal to form a pleasing result. No exact height need be given, but, as a guide for all open prospects which present great distances at a low level, it would be well to assign the horizon a position not exceeding, say, one-third the height of the picture above the base line, where it would give greater variety to the lines running from the spectator, and altogether form a more pleasing and agreeable composition. For pictures taken from an elevation, the space from base to horizon would perhaps occupy three-quarters of the height of the composition, or possibly even more; but let me here remark that the greatest care should be exercised in determining the height of the horizontal line, as it is on reference to its relative position that an intelligent observer would recognise at once the altitude from which the picture was taken. It is equally necessary to bear this in mind when making "slides" or trimming prints to guard against cutting off more of the foreground than the sky, thereby reducing the height of your horizon, and in consequence falsifying your picture.

Having decided on your horizontal line, it is necessary now to note the direction taken by the other lines, which are regulated by the position of the "point of sight."

Point of Sight.

The point of sight is always situated, as you are aware, opposite the

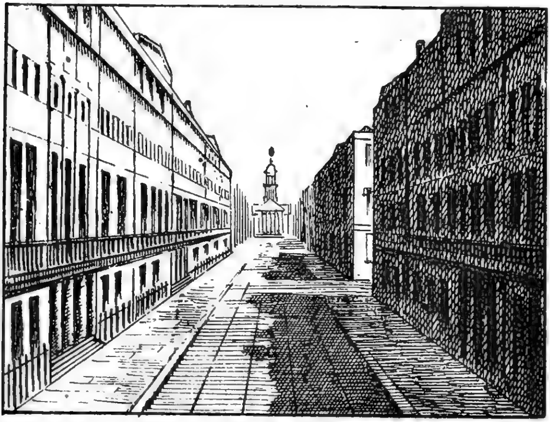

Fig. 1.

eye on the horizontal line. You will remember the fact that objects are seen by means of rays of light proceeding in straight lines, some of which meet at the eye of the observer; and I need only point out that, supposing that observer should choose the centre of a long, straight, and level street

for the scene of his operations, he would get a series of lines from the ruts, gutters, footways, and houses more suggestive of a geometrical design than a pleasing representation of an inhabited thoroughfare (Fig 1). The same remarks apply to the point of sight as were made in reference to the horizon in the undesirability of giving it a central or middle position. It should be placed, more or less, either to the right or left of the centre, so that, by presenting more of the subject on one side than another, formality is avoided, and the angles of the general lines are more advantageously varied (Fig. 2).

Having determined the position of the horizon and the point of sight, it should next be seen how the lines of the landscape compose them-

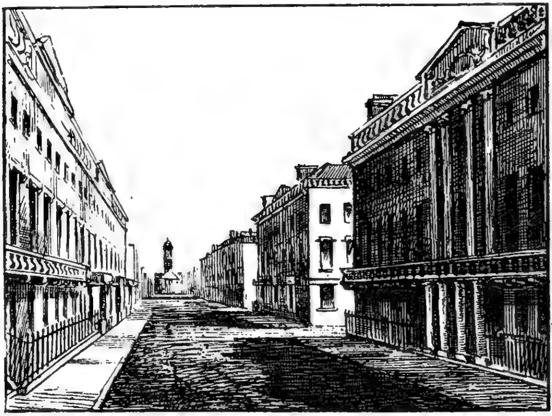

Fig. 2.

selves. Many methods have been advanced for the most perfect arrangement of lines, but in the infinite variety of subjects which are presented it is almost impossible to be guided by precept alone. Parallel lines should always be avoided, as, apart from their tendency to suggest a geological diagram, they serve to conduct the eye from side to side of the composition, a defect which should be carefully guarded against (Fig. 3). Lines which guide the sight perspectively through the picture, or which lead the eye from the foreground through the middle distance on to the horizon, are always the most pleasing and agreeable, and should invariably be selected in preference to all others (Fig. 4). Lines which have a tendency to encircle a view should not be lost sight of, as, in addition to the help they afford of keeping the eye in the picture, they also assist to concentrate the attention on the chief point of interest beyond. As instances of this effect I might cite *A Peep between Trees*, or a pathway through a wood, in which the stems and

branches of the trees would take the direction named. If in the first position you have chosen to set up your camera you find the lines of the foreground rising perpendicularly from the base line, reject it at once, and move to a spot where they shall incline either to the right or left. The lines, then taking a slanting direction, will lead the eye into the picture

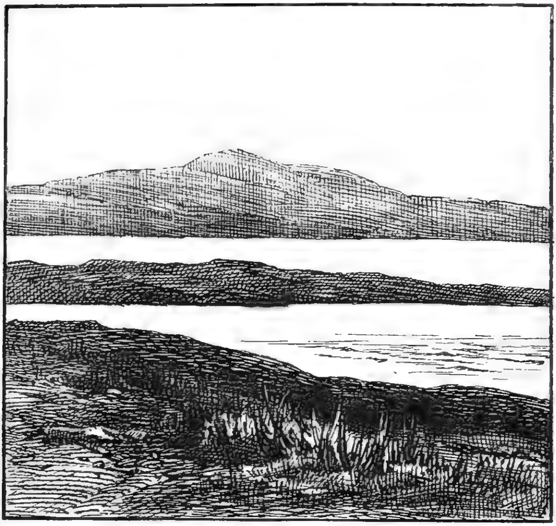

Fig. 3.

in a far more agreeable and satisfactory manner than if they had followed the vertical tendency which obtained in the first situation.

Points.

Observe where the most prominent feature of your landscape comes, whether too much in the centre of your picture or too near its limits. It is generally considered bad taste to have any object coming exactly in the centre of a composition so that it shall be equidistant from the outside lines of the picture, and this should be borne in mind when focussing the landscape, but I shall have something more to say in reference to this later on. Note whether you have one point immediately over another, and, if so, make some little alterations in your position to remedy this defect. Do not have two or more parts of your picture of nearly equal size, neither let the undulations of, say, "a moorland with

distant hills" cut up your composition into several equal portions—a circumstance of very frequent occurrence in all such situations as well as in mountainous districts.

Breadth.

Remember that simplicity of construction, combined with masses of

Fig. 4.

light and shade, agreeably disposed, are the requisites necessary to give a picture dignity and repose. Therefore, although it is most desirable to have variety and contrast in the lines of your composition, it is highly important that these values be carried to no great excess. An outline, well diversified in a natural manner, will always be more pleasing to the eye than a repetition of lines without variety; for the sight is as soon fatigued with monotony and repetition of forms as the ear is with the continued recurrence of the same sounds. The rounded forms of the clouds will contrast with the angular forms of the mountain, and these, in their turn, with the horizontal lines of water; but it is the breaking up of these masses I would particularly wish you to guard against, always bearing in mind it denotes greater talent in those who can "simplify," rather than in those who "cut up" or complicate their productions. For instance, see that your distance is not "broken up" by, say, an open row

of trees cutting across it on to the sky line, thus rendering patches of distance as seen between the trees as patches also of the trees themselves (Fig. 5). Get to some other position, in which you can either command the distant prospect without the interruption of the trees, say, above them, or else go closer to them, in order that you may get a view between them, and thus overcome the difficulty (Fig. 6).

Hundreds of otherwise good pictures are quite spoiled through lacking this great quality of "unity" or breadth, whilst those of a very low order excel, in the minds of the vulgar, in its very violation.

Let me give you an example of one of these latter. A little piece of

Fig. 5.

rock here, or a tiny bush there, two stones placed together and another not far off. A winding road which leads to nowhere, cropping up at unexpected intervals, serves to offer some foundation for travellers who are seen to keep a most regular and respectful distance from each other. A little to the right is a placid stream of water, with a wonderful lot of rushes of isolated growth and "pot-hook" form. A man in a boat adds life to this portion, whilst a bridge, at no remote distance, affords a vantage ground for one on fishing bent. It would be hard for these poor souls to be far away from any source of refreshment, so a kindly hand erects an inn, and finds a landlord too. You have often seen him. He is most generally to be observed at the door, whilst his wife leans out at the window. Two cows in marching order, single file, one red the other white, go, together with a black horse, to complete the list of all the bodies terrestrial. The prospect beyond is of great variety; heathery

moors and glowing fields, rocks of quaint geological formation, and cascades past conception to the ordinary human mind; but at last they are all merged into the distance, and find repose in the "blues."

We have seen, thus far, the most agreeable situation for the "horizon," the position of the point of sight, the tendency of the general lines, the disposition of the masses, and the desirability of maintaining "breadth" to the exclusion of "spottiness" in our pictures. We must now consider

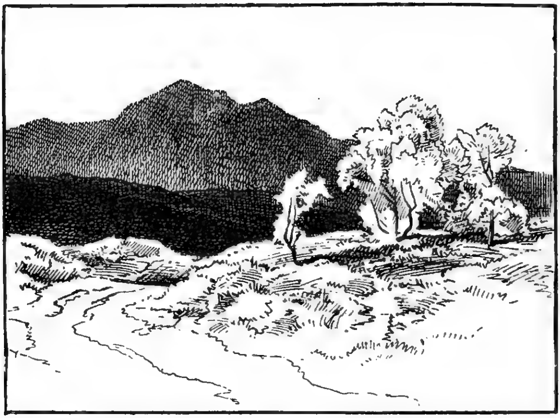

Fig. 6.

the balance of parts, or the relation which one or more masses bear to others in the composition.

Balance of Parts.

A balance of parts does not necessarily mean that equal quantities of the subject should be placed on each side of the picture. We have already noticed this unsatisfactory effect in the view of the roadway as seen from a central position. A great preponderance of your subject may exist on one side, and yet be sufficiently balanced on the other by a group of figures, an object, or a mass of either light or shade. Indeed, it is common, in most landscape compositions, to place a greater mass on one side or the other, allowing it to slope into the distance, the mass being balanced, say, if in a harbour, by "shipping," or, in the case of a roadway, by "animals or figures," the shipping, animals, or figures, *always* holding a secondary position in reference to the amount of space they occupy (Fig. 7).

Not only is this arrangement more pleasing in its lines, but it is

decidedly more picturesque in the irregularity of its parts. Another very general and agreeable composition is that in which the greatest mass is allowed to take a position a little to either right or left of the centre, sloping towards the sides, the objects which balance it being placed in close proximity (Fig. 8).

In the infinite variety of aspect in which nature is presented to us, it is obvious no code of rules could be formulated to adequately suit all

Fig. 7.

circumstances, so that one's own personal judgment must be largely relied upon for selection and arrangement, and, in proportion to the artistic knowledge we possess, so will depend the success or otherwise of our productions.

Strong Lights.

It must be remembered that brilliant light and strength of tone act in a powerful manner on composition. A very small quantity of black and white in violent contrast will require a large amount of middle or half-tone to subdue it and preserve the harmony of the whole.

You will allow me to suggest, when photographing from nature, the necessity of bearing in mind those colours which are likely to give these strong contrasts when reduced to black and white, in order that you may make due allowance for their balance in your composition. I am told it is an excellent plan to use a piece of cobalt blue glass when selecting a subject, as the tones can more readily be estimated by this means rather than on the ground glass.

Chief Point.

Do not forget there should be a *chief point* of interest in every picture which should at once arrest the eye, and in relation to which all other points must be held subordinate. Where this " chief point " should be situated

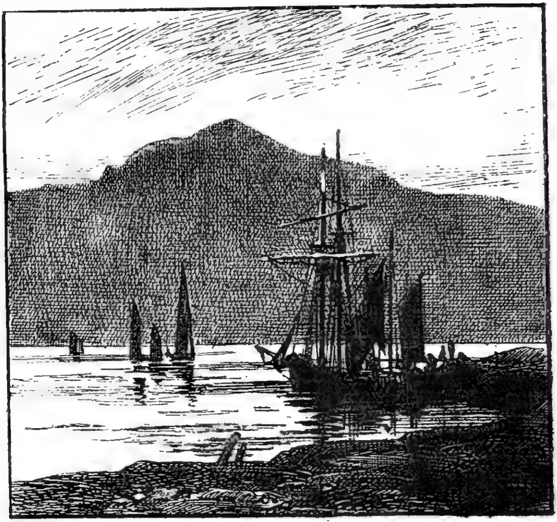

Fig. 8.

depends very much on the character of the subject chosen, but some points in a landscape are so obviously well suited for this purpose that they should at once be selected and decided upon. In historical or *genre* pictures the chief point of interest is not unfrequently placed in or near the centre, but it is by no means essential it should occupy that position alone.

Having now determined your "chief point," you will arrange the residue of your subject in such a manner as shall keep up the interest of the whole, and present to the eye an agreeable composition. One object should never be placed over another when that other is of equal size or effect, as this, by dividing the interest, would destroy the power of both. For the same reason two objects of the same size and interest should never be placed so as to appear one on either side of a middle object. One must be rendered subservient to the other to overcome this deteriorating effect.

Proportions.

The proportions of pictures may vary with the general forms of the subject selected, but they should never be exactly square. The effect of height is often aided by an upright form, but its height should be evidently more than its width. For landscapes an oblong form is most desirable, varying in length as the prospect demands.

Light and Shade.

We will next see what influence "light and shade," or "*chiaro-oscuro*," has upon pictorial effect. The words "*chiaro-oscuro*" are commonly translated "light and shade." Some writers prefer "clear obscure," or "light obscure." The term is used in reference to the lights and shadows of a picture, as also to its tones of colour.

In contemplating an extensive landscape it may have been noted that on the objects and forms nearest to the eye the most brilliant lights and the deepest shadows are seen; and that, as the distance from the eye increases, these lights and shadows gradually diminish in intensity until they are ultimately lost, blending together in a kind of greyish-blue tint. Not only is it found that lights and shades lose their intensity in proportion to their nearness or remoteness from the spectator, but, as a necessary consequence, the contrasts also are less prominent, and the outlines less distinct, the more the distance is increased.

It may be as well here to state that there is a distinction between shade and shadows, the former being used in reference to those portions of opaque bodies which are removed from direct light, and the latter the deprivation of direct light suffered by another body, occasioned by the opacity of an object which intercepts it. That it is necessary to make this distinction is obvious, from the fact that in nature there is invariably found a difference in the intensity of these two kinds of shade, the shadow being almost always darker than the shade on the adjoining body by which the shadow is cast. This can be easily seen by taking a white object, say, a cube, and placing it on a sheet of white paper in a strong light, when it will be seen the portion of the cube in shade will be lighter than the shadow it casts. This difference is occasioned by reflected light; but it is unnecessary for me to do more than just refer to it, or detain you further on the matter.

It is the intention of a good picture to tell its story distinctly and intelligibly, avoiding all things which disturb the attention. This, without a good knowledge of *chiaro-oscuro*, cannot be done, for, unless the artist strictly adheres to the leading principles of this department of art, his labour will be thrown away. His first endeavour must be to obtain unity of light and shade by so massing his lights on the chief point of the picture that the eye may dwell on it with undisturbed satisfaction. To scatter over a picture at regular intervals a variety of objects having an equal degree of light is to produce a result more nearly approaching the nature of a chess-board, where the alternating spaces of

black and white, so equal in size and power, allow the eye to wander over its surface, finding not a single point of interest on which it can repose. The quantity of dark shade given in paintings is about one quarter; another quarter is allowed for light, and the remainder for middle tint. In many excellent pictures we see the greatest part occupied by middle tint, with very little positive light or dark, and in others we find a preponderance of light, with just a little "strengthening" or "darkening" of a part to create a focus for the whole. Generally in this latter composition small spots of colour, or strong contrasts, are introduced with telling effect, as is often to be noticed in some of Turner's charming works, in which a group of figures, a boat, or even a few broken posts, give extreme brilliancy to the picture.

As we are dealing with the camera now, it will be unnecessary for me

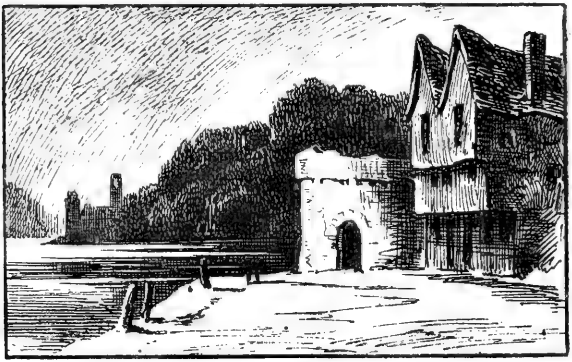

Fig. 9.

to enter into the various methods adopted by artists in the treatment of *chiaro-oscuro*, because it is obvious the photographer's art is limited to the extent that he is only able to reproduce the subject as it appears before his lens, after a careful selection of his position, &c., and the due consideration of its most suitable lighting, whereas an artist has greater scope in introducing certain effects, which may enhance the beauty of the composition, although not actually present in the particular subject before him. This would be considered under the head of "invention," which need not trouble us here.

Supposing you have chosen your position, you will note how the objects in the foreground tell, the proportions of the strongest contrasts, the amount of brightest light and deepest shade in proportion to the remaining middle tint. See the shade and shadow is not in excess, so as to produce a dark and heavy result, and that the light does not preponderate, for an exactly opposite reason whereby a weak and insipid

picture will be obtained. Do not hesitate to alter your position if these do not quite satisfy you, as no success is gained without labour, and a good negative is worth a little trouble. It will require some amount of practice to nicely determine the "values" of distant prospects, as in photography colour is reduced to black and white, with intermediate tones; but for near scenes, picturesque bits, old houses, &c., this difficulty is soon overcome when it is remembered what depth of tone certain colours produce.

Although unity of light must always be sought after, it must not be carried to too great an extreme, as repose will almost be lost by the eye being continually recalled to this isolated point (Fig. 9). In order that

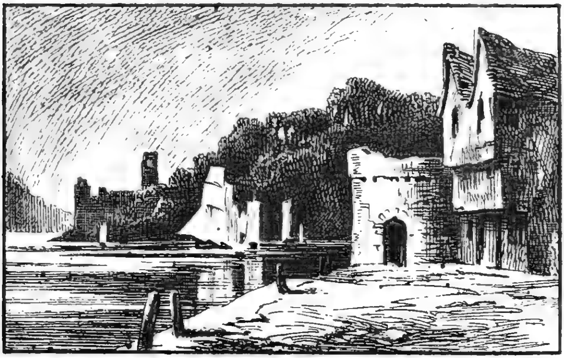

Fig. 10.

this singleness may be prevented, it is advisable that other groups of light should be admitted (Fig. 10).

These must be varied in their form, size, and degrees of power, and the breadth of the shadows so well preserved, that they may serve as places of repose to the eye, separating the groups from each other, that is, there should be *one* single portion having the most brilliant light—and consequently possessing the greatest contrast in the opposite depth of shade—to which should be added other groups of light of a less degree of intensity, whereby both unity and repose will be secured.

The term "repose" is applied to those parts of a picture, either in deep shadow or middle tint, where lights and shades are so subdued that the eye can rest upon them without fatigue, after the excitation produced by the brilliancy and effects of the principal parts.

However scattered objects may be throughout the picture, they must be so grouped and collected together that, although each object has its own particular light and shade, the lights of all should generally mass together, as well as the shades, which will give a unity of effect always to be com-

mended (Fig. 11). Cast shadows will be found of great assistance in securing this quality of unity, inasmuch as, by passing from one object to another, they connect and hold them together (Fig. 12).

Seeing that shadows are more prolonged when the sun is low, it will be well to make exposures, when possible, either in the morning or afternoon rather than exactly at noon. As, in speaking of composition, it

Fig. 11.

was suggested that lines receding from the foreground were to be preferred, so, in the matter of shadows, parallel lines should be avoided.

Interest in Objects in Light.

It is important to observe that when any object is placed in light it is essential it should either possess some interest in itself or in its accessories in order that it may have that degree of interest which alone can allow the eye to rest upon it with satisfaction. Without such care it will appear bald and uncouth, and present an uninteresting and defective appearance. Thus, if you are about to select a rustic cottage with white-washed walls, see that the portions in light have a few picturesque cracks between the stones, or across the plaster, are partly hidden by a creeper,

or an apple-tree close by. Perhaps a nail may be found on which to hang a bird-cage basket, some garden implements, a sieve, or article of wearing apparel. If a fisherman's abode, nets, crab-pots, oars and spars may be requisitioned, and, failing all these, it will possibly afford a suitable position to place a figure, care being taken in selection of colour of dress in reference to contrast. If the ugliness cannot be overcome by

Fig. 12.

any of these means it will be best to reject it altogether, or defer its portraiture until a more fitting time, when it may be seen in shade, and, in consequence, be less conspicuous.

To recapitulate, we have noticed the most brilliant lights and shades are in the foreground, gradually losing their intensity as distance increases, that there is a distinction between shade and shadow, the latter being the darker of the two, the intention of a good picture to tell its own story, which is impossible without good arrangement of light and shade, the great importance of unity in this matter to the getting rid of scattered light, various proportions of light and shade in compositions, the desirability of having more than a single spot of light and the proportionate intensity and variation in size of those added, the gathering together of

scattered objects, the assistance of cast shadows, and the necessity of having interest in the portion in light.

To determine the most suitable manner in which we may introduce our figures, and to find the most appropriate position to place them in, must be our next endeavour.

Figures, &c.

There are but few scenes in nature, however beautiful they may be, upon which the eye can rest with continued pleasure unless they exhibit some signs of animated life; consequently, few landscapes are complete without the introduction of figures or animals, which shall enlist our sympathies on behalf of the scene presented to us, and, moreover, furnish us with a scale by which we may judge of the extent of the view and the size of every other object it may contain.

Who does not know how greatly a wild stretch of mountain and moor is enhanced by the presence of deer, shaggy cattle, or horned sheep? and, supposing it to represent a spot even too dreary to afford sustenance for these, how welcome is the dark form of a cormorant rising with heavy beat from a peat-stained tarn, whose waters, chafed by the flapping wings, break into silver ripples along its course to the opposite shore! Or, to take a pastoral scene, who will deny the increased interest manifested in the contemplation of an old timber waggon with its team of horses and rustic attendants, whose demeanour, perhaps, suggesting some slight incident, no matter how trivial in itself, not only gives to the whole an air of reality and truthfulness, but lends an additional charm to the prospect presented.

Views which consist in a large measure of water, be it river, lake, or sea, find their proper embellishments in ships' barges and fishing craft of all conditions of shape and size, and of every possible description.

It is very essential in choosing an object or figure to remember it should be "in keeping" with the rest of the picture. Thus, in a village scene consisting of thatched cottages, with trees, a tiny brook, and distant country beyond, it would be highly injudicious to introduce an individual whose chief attributes consist of a stove-pipe hat, with coat and trousers of the latest West-end cut and design, to say nothing of "spats" upon his feet, and a stick and glass complete, very proper, no doubt, to his mind, for Piccadilly, but utterly unfit for the purpose we require. Rather let us look about for one whose clothes bespeak honest labour, which have long since lost the creases they once possessed in the shopman's windows, having, in part, become moulded to the form which lives beneath them.

Another point I should like you to consider is the "pose" of your figures. It must be admitted that, in many cases, there is a lack of grace in country-side folk and a certain amount of crudeness, or angularity, call it what you like, about their natural attitudes. Perhaps no one better than a painter knows the great difficulty there is in overcoming this unfortunate effect, the most trying part of which is, that, the more you endeavour to get your models into a pleasing attitude, the more rigid and angular they become. They have the knowledge they are being

"took," and, as they generally hold views diametrically opposed to those of the artist on such matters, a pleasing result is only obtained after much tribulation. This is, however, most to be remarked in persons of middle life and onwards, as children of both sexes and those in the hey-day of youth generally pose themselves in very pleasing attitudes, quite befitting their country life and occupation.

Whilst it should be your aim to place your figures in such a manner as shall present agreeable lines in your composition, be *very careful* you avoid the other extreme in giving them a species of classic pose more suggestive of Junos or Dianas than the simple folk of a country village, remembering you had better a thousand times have angular and even somewhat ugly forms in your pictures than that such a result should obtain.

These remarks apply to rustic scenes and general landscape views, and, inasmuch as a West-end fop would be "out of keeping" in proximity to thatched roofs and whitewashed walls, so would a ploughboy in a like degree be out of place in a London-drawing room, however much you might wish to emphasise contrast. Always see, then, that your figures are suited to the situation you intend them to occupy, and endeavour to place them in as natural and easy a posture as possible.

Now, as to where they should be introduced in your compositions. This will entirely depend on the subject you select, and what you determine shall be your strong point. If you decide that an object in the landscape shall first arrest attention, the figures will then have to hold a secondary position; but, if there is nothing of any particular interest in your view, let the figures be made of more importance. They will generally be found useful as a "balance" in the composition, or as a "contrast," the irregularity of their outlines being opposed to the lines and angles of buildings, as also their apparel, to the darker tones of vegetation, or *vice versâ.*

Another point you should consider is, whether you intend to make a "figure subject" or a "landscape with figures," as on this depends the size of the figures, or the space they should occupy. Avoid having them of such a size as would leave any doubt in the mind of the observer which was the more important part of the picture, the figures or the landscape. If the former, the prospect beyond should be broad and effective in its masses; if the latter, then the figures should be just sufficient to serve as a scale, and give additional interest to the whole.

In "grouping" care should be taken that no two groups are of the same size, nor placed in opposite positions. Always endeavour to have one group larger than any others, both as regards number and the space it occupies. Generally, groups should diminish in the space they occupy as they recede from the eye. If the light admits, try and connect them by means of the shadows they cast; sometimes a dog will be found very useful to this end. In placing your models avoid formality, aiming rather at irregularity in their outlines. You do not want a regiment of soldiers; hence never arrange them in line, have some portion of the group higher at one point or another, not forgetting that nets or farming implements carried on the shoulder will materially assist you in this

direction. If you have a preponderance of vertical lines in your composition, let the figures pose in such a way as shall cut them obliquely;

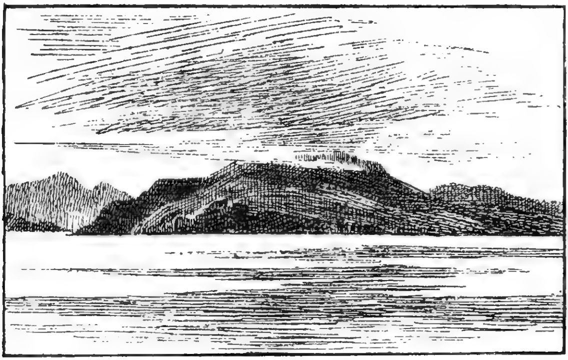

Fig. 13.

should horizontal lines be in excess, connect them with those of perpendicular tendency (Figs. 13 and 14).

The "relief" which figures afford in your pictures must receive some

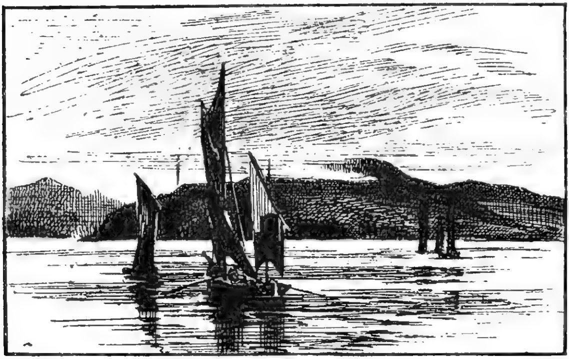

Fig. 14.

consideration; and, perhaps, in no instance will it be more necessary to remember what tones certain colours take when reduced to black and white. If this is overlooked, it will be found, after much care and trouble have been expended on their arrangement, you will get no effect, owing to

the colours of the apparel worn by your figures being so near in tone to whatever may form their background.

If your background is light, you will have greater "breadth," if the tones of the dresses produce a light middle tint. If contrast is required, you will have recourse to pronounced tone; but, supposing you have a street view in some village, the brightest light being on the side of a house or wall, it is by no means necessary you should straightway select that spot as the most suitable to place your figures wearing the darkest clothes, unless you desire to rivet the attention of the observer on that particular point. It is impossible, in the infinite range of subjects which will commend themselves to your notice, to say where your figures should be placed in every instance. If you have natural taste, positions will be suggested almost at a glance, and it will only remain for you to bear in mind some of the precepts which have been enumerated, in order to determine which is the most suitable, in keeping with the laws of composition.

To those who do not possess this precious gift, but who are anxious to produce pictures having some claim to artistic merit, I can only advise they should endeavour to master these rules—a by no means insuperable task—at the same time taking note of good work executed by others, not only in photography, but in every branch of pictorial art, and, above all things, continually going to Nature, closely studying her under her many aspects, thereby acquiring a knowledge which can never fail to interest, and which will always elevate and refine.

Let me say, in conclusion, I hope these remarks on composition may assist you in your future efforts with the camera; and, although at first sight it may appear a difficult matter to overcome, it should be remembered, so vast is the importance of its principles to the artist, that any time spent upon their acquisition will be well bestowed. Of this, however, we may all rest assured, that no portion of sound knowledge is ever gained without some corresponding amount of exertion, and equally certain is it that "excellence is never granted to man but as a reward of labour."

The following works have been referred to in the foregoing remarks: —*Theory and Practice of Landscape Painting*, by George Barnard; *Theory of Painting*, by T. H. Fielding; *Model Drawing and Perspective*, by Williams.

PROCEEDINGS & TRANSACTIONS

OF THE

CROYDON MICROSCOPICAL & NATURAL HISTORY CLUB.

FEBRUARY 11, 1891, TO JANUARY 13, 1892.

CROYDON:

PRINTED FOR THE CLUB, BY WEST, NEWMAN & CO., HATTON GARDEN, LONDON.

1892.

PROCEEDINGS

OF

THE CROYDON MICROSCOPICAL AND NATURAL HISTORY CLUB.

1891—92.

Twenty-second Annual Meeting.

Held at the Public Hall, Croydon, January 13th, 1892.

EDWARD LOVETT, President, in the chair.

THE Balance-sheet of the accounts for 1891 (p. clxxviii) was taken as read and passed.

It was then proposed by the Hon. Secretary, seconded by Mr. P. Crowley, and carried, that Rule 1 (management of the Club) be altered by adding the words "a Librarian" as a member of the Committee, and that Rule 5 (membership) be altered by adding the following words at the end :—"And any member more than one year in arrear may be struck off, unless special cause to the contrary be shown to the Committee."

Mr. Bayard having resigned the office of Hon. Secretary, and it being considered to be detrimental to the interests of the Club to change both its President and Hon. Secretary at the same time, it was proposed by Mr. Crowley, seconded by Mr. Mennell, and carried unanimously, that the rule affecting the eligibility of a President for re-election be suspended for this year, and that Mr. Lovett be asked to occupy the chair for one year longer.

On the proposition of Dr. Franklin Parsons, seconded by Mr. Cushing, Mr. Sturge was unanimously re-elected Treasurer, and a vote of thanks was accorded to him for his services during the past year.

It was proposed by the President, and seconded by Mr. W. Low Sarjeant, that Mr. Walter Budgen be elected Hon. Secretary in

the place of Mr. Bayard, resigned; this was carried unanimously, and a hearty vote of thanks was passed to Mr. Bayard for his services as Hon. Secretary.

Mr. Bayard was then, on the proposition of Mr. Sarjeant, seconded by Mr. Goodman, elected Librarian.

No other nominations having been received, Mr. T. D. Aldous, F.R.M.S., and Mr. J. Weir Brown were elected to serve on the Committee in the place of Mr. James Epps, jun., and Mr. C. F. Oakley, who retire in accordance with the rules.

The following is a list of the officers for the year 1892:—

President.—Edward Lovett.

Vice-Presidents.—John Berney, F.R.M.S.; Philip Crowley, F.L.S., F.Z.S., &c.; Henry S. Eaton, M.A., F.R.Met. Soc.; Henry T. Mennell, F.L.S.; Henry G. Thompson, M.D.

Treasurer.—Edward B. Sturge.

Hon. Secretary.—Walter Budgen.

Librarian.—F. C. Bayard.

Committee.—T. D. Aldous, F.R.M.S.; J. Weir Brown; A. B. Carpenter, B.A., M.R.C.S.; C. H. Goodman; H. D. Gower; W. Murton Holmes; K. McKean, F.L.S.; W. Low Sarjeant; Ernest Straker.

The President then delivered his Address, at the conclusion of which a cordial vote of thanks was accorded to him for his Address, and for his services during the past year.

The President's Address.

Gentlemen,

In adopting the well-established custom of reviewing the past year's history of our Club in a Presidential Address, I think we may congratulate ourselves that our society is still in the ascendant. During the year we have enrolled 42 new members, and lost from various sources, chiefly by removals from the district, 33, leaving a net gain of 9 members, or exactly the same increase as in 1890. We now number 303 members, which is a remarkably good roll for a Club that has existed for 22 years without once making a backward movement. I trust that our present members will still further help to enlarge our membership, and thus strengthen their Club during the present year by inducing their friends to join.

I will now say a few words upon the next important matter, namely, our financial position, which is after all the source of life of all undertakings involving expenditure. A year ago I drew particular attention to the alarming way in which our expenditure was exceeding our income. This year that has

happily ceased, and we stand in a really strong position considering the numerous and heavy calls upon our comparatively slender income. From the Balance-sheet before you it will be seen that we leave off with some £13 in hand. Of this, however, £10 consists of donations specially given towards the Rainfall Returns for the ensuing year (for which also £12 more is kindly promised). This reduces our actual balance to £3 as against £22 last year. But upon looking down the expenditure for the year 1891, it will be seen that several large items have been paid which belong to 1890, the accounts for which had, I believe, not been sent in in time. Amongst these is £24 for printing Transactions, £7 share of Rainfall Returns grant, and £9 for Soirée of 1890; so that in reality we began this year with liabilities of at least £40 against a balance of £22. At the present, however, our accounts are practically all paid up, and our balance, though small, is our own.

Again our prospects are good, for, besides the two generous donations of Mr. Baldwin Latham and Mr. Compton Rickett towards our Rainfall expenses, we have, as I said, £12 more promised; so that with care we should close the present year with a net credit balance of £30.

It will be seen from the Balance-sheet that a great saving has last year been effected in our Soirée expenses, which amounted last November to £31, as against £60 for 1890. The modifications in our arrangements which led to this saving did not meet with universal approval, but they have at least been the means of relieving your Committee from the position of having to report that the Club was in debt to the extent of some £20. The further generous donation of £5 by Mr. McKean was for the benefit of our Photographic Section.

As regards our Special Fund, which, as you are aware, is available for appliances, apparatus, books, &c., useful to our Club, we have a balance of £22. Although we have a fairly good library, I do not think we possess any practical works on photography, except the current journals, which have been kindly given by Mr. Gower. I therefore think, as we have so many photographers amongst us, that a few books for their use might with advantage be procured.

Our Sub-Committees continue to work in their various subjects, but I think some might do more, the chief delinquent, I fear, being my own Section, the Geological. The Reports of the Sub-Committee Secretaries for the past year are as follows:—

Report of the Botanical Sub-Committee, January, 1891.

Since our last Report some valuable additions have been made to the Club Herbarium, notably a series of specimens of Surrey *Epilobia* (willow herbs), including several hybrids from the Rev. E. S. Marshall,

of Whitley. The genus *Epilobium* is one of the most difficult, owing to the readiness with which the species composing it hybridise.

We are not aware of any additions to the records of Surrey plants during the year. Mr. Beeby writes :—"We cannot now expect many new records for the county; our work lies among the critical genera, and in testing what are really varieties and what are merely states, &c."

It may, however, be noted that *Senecio viscosus* has appeared in considerable plenty this year on the new roads on Park Hill. It is a rare and local plant in the county, and, we believe, not previously recorded from the neighbourhood of Croydon.

At the Field Meeting to Caterham and Whitehill, on the 3rd August, the botanists of the party found ample employment, the most noteworthy of their spoils being the curious saprophyte (or parasite on decayed vegetable matter), *Hypopithys multiflora*, found in plenty under the beeches at the top of Whitehill.

In our last Report we referred to the occurrence of *Phylloxera* at Kew, on the strength of a newspaper paragraph. Mr. R. McLachlan informs us it was at the Royal Horticultural Society's Gardens at Chiswick that the pest appeared; but it was, as we stated, promptly got rid of by burning the plants and soil.

At the recent Soirée the Collection of the Club was exhibited, and made a good show. Amongst the other botanical exhibits may be noted a fine series of rare Welsh plants by the Messrs. Salmon, of Reigate, including *Lloydia serotina, Helianthemum Breweri, Cineraria spathulæfolia*, &c. This exhibit was noteworthy not only for the intrinsic interest of the plants themselves, but also for the beauty of the specimens, and the care bestowed in their mounting.

Mr. Mennell exhibited specimens of orchises (*O. pyramidalis, O. conopsea*, and *O. apifera*) dried after being treated with sulphurous acid, by which the colours are admirably preserved, and retain much of the vividness and beauty of the living plant. The plants are immersed in a solution of equal parts of sulphurous acid and methylated spirit for about ten minutes before being dried in the usual way. Another method recommended by our fellow-member, Mr. Packham, is to dust the plant over with dry salicylic acid when putting it into the press, and to renew the operation when first changing the papers; he states that he has tried this method with much success. It is desirable that both methods should be further tried, and the results reported to us.—HENRY T. MENNELL, *Hon. Sec.*

REPORT OF THE GEOLOGICAL SUB-COMMITTEE, JANUARY, 1891.

I regret that, owing to the little that has taken place during the past year in the way of penetrating the surface of the ground, there is little or nothing come to hand for me to record.

The Excursion of August 3rd was under the direction of this Sub-Committee. Owing to the threatening nature of the weather, very few members put in an appearance, eight being the number which started from Caterham at the appointed time (11 for 10.30 a.m.) the weather then being very fine. The route taken was across the Valley to Whitehill. Wild flowers were in profusion, and many plants of interest were gathered. Lepidoptera was also faily abundant; among others, *Zygæna filipendulæ* was common. Butterflies, however, were

scarce. Besides a profusion of Hymenoptera, Diptera, and many Coleoptera, on Whitehill, the curious larva of the fox moth, *Bombyx rubi*, was found.

After noticing the chalky pebble bed which caps part of Whitehill, the party enjoyed the very extensive view obtained from this point, distant spots being very plainly seen, and were enabled to follow the various outcrops and escarpments most distinctly for many miles. The hill was then descended, and a spring at the junction of the upper greensand and gault was observed; a disused brick-yard, densely clothed with vegetation, offered a small section of the gault-clay for inspection. A little farther on the road photographs were taken (three cameras being amongst the party) of an interesting old gabled farmhouse. After this the rich corn-growing strip of ground characteristic of the lower greensand formation was traversed, and the village of Bletchingley was reached, where other photographs were taken of the old church with its stout square tower, also of some picturesque bits in the village street. The walk then led past the old village pound to Nutfield, where attention was called to the fuller's-earth pits of the lower greensand formation.

The party returned from Red Hill at 4.15 p.m. after a remarkably pleasant day, the weather being perfection, with the exception of two very short showers. Upon reaching Croydon, however, a very heavy hail and thunderstorm was just clearing, to be followed, however, by four others during the evening.—Ed. Lovett, *Hon. Sec.*

Report of the Meteorological Sub-Committee, January, 1891.

The Meteorological Sub-Committee has continued its work under the supervision of its Hon. Sec., Mr. Bayard. The daily rainfall of 50 stations in the Club district has been tabulated every month, examined, and corrected, and the results printed and issued to the observers and all members of the Club interested in the question either before or within a very few days after the end of the month succeeding that to which the statistics refer.

As the monthly sheet is now full, it is proposed not to print the daily values of more than 50 stations, and, with respect to all other stations in the district, to give the monthly totals in the Sub-Committee's annual report. Having regard to the very important question of the water supply of London, the value of the Club's work through its Meteorological Sub-Committee is becoming greatly appreciated.

At the beginning of the year the Committee made a grant to the Meteorological Sub-Committee of £25 for the expenses connected with the rainfall returns. The actual amount paid out in the course of the year is £32 7s. 1d., but this amount included part of the grant of 1890, and on the two years there is a balance in favour of the Club of rather over £1, which the Sub-Committee regard as satisfactory.—F. C. Bayard, *Hon. Sec.*

Report of the Microscopical Sub-Committee, January, 1891.

I am sorry to say that there is nothing particular to report. The slide cabinet has been arranged, but only two or three sets of slides have been borrowed by members.

The only event of the year was the special evening with the microscope on the 29th April, 1891, when the following gentlemen exhibited a variety of interesting objects under their microscopes, *viz.:*—Thomas Aldous, J. H. Baldock, J. Berney, P. Crowley, J. Epps, jun., C. H. Goodman, H. Greenway, W. M. Holmes, E. Lovett, J. E. Syms, E. B. Sturge, N. Waterall, W. B. Priest (Quekett Mic. Club).

It would be a good plan if we could combine to get more of the "evenings with the microscope," but so many of our members have given up their microscopes for photography, that it is somewhat difficult to get a sufficient number to exhibit. I am glad to see that the latter section has been doing some excellent work in photographing microscopic objects, a combination of science and art which ought to be productive of some interesting evenings with the lantern.—W. MURTON HOLMES, *Hon. Sec.*

REPORT OF THE ZOOLOGICAL SUB-COMMITTEE, JANUARY, 1891.

The Report of the Zoological Sub-Committee is somewhat brief, and I have therefore embodied a few remarks of my own with it.

Mr. Berney writes that "*Sambucaria*," in its larval state, hybernates, feeds up again in the spring, and does not appear as an imago till the latter end of June. I had some larvæ this autumn, and five of them changed to pupæ; two came out on December 24th, 1891, as *imagines*.

During the summer Aphides had been troublesome in gardens, especially the woolly aphis or American blight. I may mention that a good remedy for these pests, as also for swarms of caterpillars on trees, is as follows:—Syringe the affected trees just before rain with a mixture of a gallon of water in which is dissolved a little soft-soap and a teacupful of paraffin oil added and well stirred in.

The larvæ of *Mamestra persicaria* were very abundant, eating up all flowering plants. The common white butterflies were, as of late years, quite rare in our gardens.

Cheimatobia brumata.—On Sunday evening, Nov. 29th, about 6.30 to 10 p.m., there were a great number of the males of this moth on the road lamps at Addiscombe. I examined about 20 lamps, and every one had some of these moths upon them. I counted 25 specimens on one lamp, and there were as many on several others. In the main road there were only a few (three or four) on each lamp, and the larger numbers were all on lamps in the lower parts of the locality. The weather was misty and damp; a dead calm, temperature about 43° F. The larvæ of this moth do immense damage to various trees, and the females are semiapterous.

REPORT OF THE PHOTOGRAPHIC SUB-COMMITTEE, JANUARY, 1891.

During the past few years the Photographic Section has been steadily growing, and at the present time it is probably the strongest section of the Club.

A brief history of its growth perhaps would not be amiss, as it will show that when photography was first introduced into the Club it was by no means a bad speculation, as we have gained many new members other than pure students of nature.

In 1883 and 1884. The Section was not known, but there were

probably many who practised this art, but had no means of bringing their exertions into prominence.

In 1884 to 1886. We hear our new Photographic Section spoken of, but then very few in number.

The year 1886 and 1887. Again the Section is alive, and noted as being most active during that year.

1887 and 1888. The Photographic Section is chronicled as having 15 members, and the first Friday in each month was fixed for meetings of the section, apart from the General and Conversational Meetings of the Club.

1888, 1889. 31 members are notified, and at that time it was probably the strongest section that the Club had.

In 1889, 1890, 43 members.

In 1890, 1891, 60 members.

And the present year (1891—92) we muster 73 members, which is very satisfactory; and I am happy to say we are still on the increase.

Seven excursions were made during the summer:—April 11th, Addington Park; April 25th, Oxted and Godstone; May 9th, Arundel; May 23rd, Groombridge; June 6th, Haslemere; July 25th, Kingston; Sept. 12th, The Ballards. (And the Photo. Section has also availed itself of the rambles and field excursions arranged by the other sections of the Club). All the excursions have been fairly well attended. The whole days were not perhaps quite so well patronised, owing to the inability of members to get away.

The half-day excursion to Groombridge, under the direction of Mr. Carter, was the best attended of any; 23 members availed themselves of the opportunity to be present.

The Technical and Conversational Meetings have been well attended, and the dark room has been used; but latterly, owing to accidents with regard to overflow of water, which made the room damp, we have been compelled to hold our weekly Conversational Meetings in the Club-room. Now, however, alterations have been made that will, I hope, render this room more useful to the Club.

It has been arranged to hold meetings, and to have definite papers and subjects, every Friday evening for the future, and such subjects allied to photography as will promote discussions; and, though these meetings are promoted by the Photographic Section, it is hoped that the members of the Club at large will avail themselves of them; and I can only repeat what has been said before as to the desirability of the union of the Photographic Section with the whole of the other Sections for the purpose of assisting them to illustrate the valuable communications made to the Club from time to time.

At the Soirée this year the Section was fairly well represented, but many looked-for exhibitors were absent, probably owing to the past season having been hardly up to the standard for good photographic work, and also owing to many members using hand cameras, which produce pictures hardly large enough for exhibition.

There was a good show of transparencies, some hundreds of lantern slides and transparencies being on view, and showing a high state of perfection.

In conclusion, I must say that the Section is as flourishing as ever it was, and that by continued exertions on the part of the members it will gain a prominence that has not before been obtained.—HARRY D. GOWER, *Hon. Sec.*

The excursions for the year, like many other things in 1891, suffered severely from the weather, the first one, on Whit-Monday, being perhaps the greatest sufferer in this respect.

Whit-Monday, 18th May, 1891.—This excursion was arranged by Mr. E. B. Sturge to leave Croydon per rail about 10 o'clock for Cowden in Kent, thence walk to the village, where there are several old half-timbered houses and an old church, the tower of which was much damaged by lightning a few years since; then cross the "Kent Water" into Sussex at Holtye Common; near this, the Furnace Pond, is a large sheet of water with a mill. Continuing the walk to Hammerwood Church and on to East Grinstead, about eight miles in all. The morning being extremely wet and stormy, only two members, Messrs. Goodman and Sturge, turned up, but they carried out the programme, returning by rail to Croydon.

The visit to Kew Gardens, on June 20th, under the direction of Mr. Mennell, was of much interest, the Alpine and herbaceous rock garden being examined with much pleasure. Visits were also paid to the most interesting of the houses, and an exceedingly pleasant and instructive afternoon was enjoyed by the party.

Ightham Excursion.—On July 11th an excursion took place to Ightham, under the direction of Mr. Bayard. A small party met at Beckenham Station and proceeded to Borough Green Station. On arriving there the party walked to Ightham, where they spent some time inspecting and photographing a very old house, which was said to have been the palace of the last Roman Catholic bishop in England. Thence the party went *viâ* Oldbury, past the Roman camp and Ightham Common to Ightham Mote House, a very celebrated "moated grange." This being under repair, the interior could not be seen. Thence the party returned to Ightham and Borough Green. The weather was magnificent. Some orchids were found on Ightham Common, and an adder was captured after considerable trouble.

The August Bank Holiday excursion is referred to in the Report of the Geological Sub-Committee.

On Sept. 5th a visit was made to the Zoological Society's Gardens, under the direction of Mr. Crowley. A considerable number of members were present, and an exceedingly pleasant afternoon was spent. Through the influence of Mr. Crowley, many little points of interest were shown which would not otherwise have been. A pelican race was one of these, as also was a private view of the toucans and hornbills, when their curious manner of catching food thrown to them was shown. A friendly visit to the anthropoid apes was also made, where the celebrated "George," which shortly afterwards unfortunately died, was inspected by the party. The weather was remarkably

good, and several photographs of animals and birds were taken by some of the photographic members of the Club.

During the year twelve papers have been read at the ordinary meetings of the Club, and one lecture has been delivered in the large Public Hall, to which members and their friends were invited. The subjects of the papers were as follows, *viz.*:—

February 11*th.* — The "Annual Rainfall Report" was presented by Mr. F. C. Bayard, the statistics and calculations being tabulated with our Secretary's usual care and painstaking. The tables appear in full in our last Report (Trans., Art. 91, p. 285). "Discussion on Wandle Temperatures," from observations by Mr. F. C. Bayard. These also appear *in extenso* in the above-named Report (Trans., Art. 92, p. 316).

March 11*th.*—"The Respiration of Insects," by Mr. C. H. Goodman. This very interesting paper, which was admirably illustrated by slides thrown on the screen by the optical lantern, referred, firstly, to the various forms of respiratory apparatus, and then proceeded to deal with the structure and functions of branchiæ, tracheæ, spiracles, &c., of land and aquatic insects. The paper itself will appear in our 'Transactions' (Trans., Art. 93).

April 8*th.* — "Notes on the Prehistoric Lake Dwellers of Switzerland," by me. In this paper I briefly described the investigation of these lake deposits. I then alluded to the various forms of stone and bone implements used by these early people, and then gave a brief sketch of the probable condition of their civilisation and social status as deduced from an examination of the relics left by them. This paper will appear in our 'Transactions' (Trans., Art. 94).

May 3*rd.*—"Volcanic Action and the Structure of Igneous Rocks," by J. J. H. Teall, Esq., M.A., F.R.S., F.G.S. This paper dealt in a very descriptive manner with volcanic phenomena, and was illustrated by means of slides thrown on the screen by the optical lantern. Volcanic cones, intrusive veins, traps, and dykes were thus illustrated. Views of existing volcanoes and craters were shown, as well as cliff sections showing the effect of volcanic action in early geological times. Some views of dykes were shown, in which the intrusive vein of volcanic rock had been left like a wall, owing to the disintegration of the softer sandstone through which it had been originally intruded. The lecturer then described the structure of volcanic rocks and their mineral composition, illustrating his observations by a fine series of microscopic rock sections; these showed the structures of granites, syenites, basalts, pitch-stones, rhyolites &c., and referred to some specimens of the latter from the north

coast of Jersey, in which the structure showed a gradation from the laminated lava-flow form to the spherular bodies of various sizes which occur in this rock. Crystals of olivine, quartz, felspar, &c., were also referred to, and their characteristic forms and structure shown by the optical lantern.

September 9th.—Four short papers were read at this meeting, *viz.*:—"On the occurrence of larvæ of the Goat Moth, *Cossus ligniperda*," by Mr. W. Murton Holmes; "On the Sand-wasp, *Ammophila sabulosa*," by Mr. C. H. Goodman; "On a double nest of the Great Tit built in my garden at Addiscombe," by me; and "On the use of the Storm Petrel as candles in the Shetland Islands," also by me. These papers will appear *in extenso* (Trans., Arts. 95, 96, 97, and 98).

October 14th.—"On a new Sense," by Mr. Augustus Wheeler, being the history and growth of spectrum analysis, with some of its applications to the arts and sciences, illustrated by means of the optical lantern. After a reference to the nature of light, the lecturer proceeded to trace the history and growth of the science of Spectroscopy from the great discovery of Newton of the composite character of light to its refinements at the present day. Having described the construction of several of the various forms of spectroscope now in use, and touched upon some of their applications in the arts, he concluded by devoting some time to the consideration of the very important aid this branch of science has rendered to Astronomy, giving the greater prominence to the measures of motion in the line of sight, in both the solar and stellar economies, which this method has rendered possible, laying special emphasis on the recent discoveries of invisible companions of variable and double stars which were not hitherto suspected of being binaries, but which have been proved to be so by their motions as revealed by the spectroscope. The lecture was illustrated with a large number of lantern slides, several of which were actual photographs of spectra, and of the heavenly bodies themselves.

November 2nd.—"On the Polarization of Light, illustrated with numerous brilliant slides by means of the Optical Lantern," by Mr. J. J. Briginshaw. This very interesting paper, after dealing with the principles of polarization and the invention of the apparatus as adjusted to the microscope, proceeded to show, by means of numerous slides of great beauty, how certain colours and changes of colour were capable of being produced; and also how the power of exhibiting colours could be utilised for the detection of minute mineral crystals in thin sections of rock; as well as for showing the structure of metallic and other crystallisations when formed by themselves. The lecturer showed a pretty experiment in the displacement of the atoms in glass, and consequent polarization caused by pressure, thus illustrating the

elasticity of glass. He also successfully showed the growth of crystals under polarized light.

December 9th.—"On the Signs of the Seasons," by Mr. Epps. In this paper, which was of considerable length, Mr. Epps referred to the occurrence of animals and plants throughout the twelve months of the year. In the early part of the year our animals and birds are in winter clothing, and plant-life, except in a quiescent state, is scarce. Soon, however, the very early flowers begin to appear, and later on, when our spring flowers bloom, the summer migratory birds revisit our shores, and nests of the early pairers are built. Then later migrants arrive, and insect-life becomes abundant among the now flower-clad fields; then follows a period of stillness in the song of birds, and a temporary scarceness of flowering plants, to be again followed by the fulness of bloom of late summer, the commencement of the season of fruit, cereals, and berries, and the departure of some of our birds. Then comes the time of harvest, with its characteristic flora, and the tints of autumn. Later, our last summer migrants leave us, our flowers linger on at the mercy of the weather, and once more our native birds and animals assume their winter garb; our last flowers disappear, and the country is once more bound in the iron bands of winter's frost.

On March 18th a lecture was kindly given in the large Public Hall by Col. Charles Swinhoe, F.L.S., entitled "Mimicry in Nature." For this lecture, to which members and friends were invited, the Club is indebted to the generous kindness of Mr. Crowley, who himself engaged the Hall, and arranged other matters on our behalf. The subject, which was illustrated with a number of photographs and paintings shown by the optical lantern, dealt mainly with the protective colorisation of forms of insects, although brief reference was made to one or two crustaceans, arachnids, and fishes. The lecturer first dealt with protective resemblance, then with aggressive resemblance, and lastly with mimicry, as it is called, where one creature liable to molestation becomes somewhat similar in appearance (through natural selection) to one not so liable. The lecture, which will appear in our 'Transactions,' was attentively followed by an audience of 334 persons (Trans., Art. 99).

The Twenty-second Annual Soirée of the Club was held at the Institution on Wednesday, Nov. 25th last, and was one of the best that has taken place. It had been decided to do without the usual refreshments, and, although this modification in the arrangements did not meet with universal approval, a glance at our Balance-sheet will show that the retrenchment was justified by our financial position, for had we incurred the same

expenses as on the previous occasion we should start this year with a debtor balance of about £20, instead of a small balance on the right side. In point of exhibits, we have seldom if ever had a better collection at our Soirée. There were 80 microscopes contributed by our own and eight other Societies. The Photographic Section showed a fair number of pictures, and arranged a very attractive table of transparencies. A lantern exhibition also took place in the Old School of Art Room, and this was very extensively patronised during the evening. Mr. Crowley, to whom we were much indebted for a large number of decorative plants, showed a large series of Lepidoptera of the Indo-Australian Region; and Mr. Elliott a miscellaneous collection of antiquities. My own contribution was a collection of smoking pipes from all parts of the world, illustrating primitive aboriginal form and design in such objects. Mr. Bidwell brought a series of weapons, illustrating the development of the means of firing gunpowder. Mr. Drage had a very nice collection of nests and eggs of the eider duck; and Mr. Thorpe, of George Street, lent some very fine stuffed birds and animals, which greatly added to the unusually fine effect of the stage decoration; he also showed some good sponges and corals. There were a large number of other objects of interest shown by various members and friends, and the School of Art assisted with a selection of works by pupils, which added not a little to the success of the evening. Mr. Mennell kindly undertook the arrangement of the Club's herbarium in the Small Hall, and there were besides several good collections of botanical specimens. This is referred to in the Report of the Botanical Sub-Committee. The usual exhibit of flowers gathered in the open air at Addiscombe on the morning of the Soirée reached, in number of varieties, 140, which is remarkable when we consider the very severe and sudden frost of the October previous, which absolutely destroyed all dahlias, nasturtiums, and other soft plants. The arrangements as to tables, decoration, &c., were much better than usual, and the carefully worked-out details as to spaces for exhibitors were, as usual, in the skilful hands of Mr. Berney. Although both halls were well filled with exhibits, very many more might have easily been obtained; and I am sure that if necessary we can give many Soirées from purely local resources, for we appear to have far more collections and objects of interest in our midst than we ever suspected. The total number present was 630.

Our Conversational Meetings have been no better attended than formerly, except, of course, those of our Photographic Section, when the capacity of our one little room is severely tested. I regret to say that the dark room, to which I had looked forward as being of such use to the Club, has been so far

a failure, simply on account of the place proving utterly unfit for even temporary human habitation owing to its dampness. I am, however, glad to say that the Institution Committee, and their present courteous secretary, have expressed themselves anxious to do all they can to make us comfortable; so that I hope our photographic friends will find the place soon fit for work.

This brings me to a point which I consider an interesting one. During the past year you will see that we have had four ordinary papers and one general lecture, *viz.*, "Respiration of Insects," "Volcanic Action," "Spectrum Analysis," "Polarization of Light," and "Mimicry in Nature"; all of which were illustrated by either direct photographs or by hand-drawn diagrams, &c., shown on the screen by the optical lantern. I need hardly say that such illustration is not only far superior to the old diagram style, but it is of exceeding value in placing the subject of lectures and papers before us in a pleasing and *true* light.

The co-operation of our Photographic Section is thus an established fact, and I look forward to much more and more widely extended assistance in the future, when our 'Transactions' will, I hope, contain some proofs of their energy and industry in the shape of illustrations to some of our papers. There is practically no limit to the usefulness of the camera, and I believe that we are only yet on the margin of what is likely to be done in this direction; and this naturally leads to the consideration once more of our future, and of our accommodation. Last month I received the following letter from Dr. Carpenter,* who has given me permission to include it in my Address, indicating, however, that it only represents his individual opinion:—

"Esplanade Hotel, Ventnor,
"Dec. 15th, 1891.

"My dear Mr. President,—My long and serious illness has prevented me fulfilling a promise that I made you in the beginning of this year, that I would endeavour to formulate a scheme for housing the Natural History Society at the Public Hall. Before, however, I draw up that scheme, I should like to know from you the amount and character of the accommodation that you would require, and the rent that the Club could afford to pay, promising that, if the arrangement is carried out, it shall be a permanent one, similar to that with the Committee of the School of Art. We can provide any amount of dark-room accommodation in the basement. Room could also be provided

* Dr. Carpenter's lamented death, on the 27th January, 1892, adds a melancholy interest to this communication, which shows that the interests of the Club were near to his heart up to the last.

for a museum to be constructed at some future time in the roof; a large room for meetings of the Club, which would not be appropriated entirely to Club purposes, but be held on terms similar to those now in operation, and, of course, a library and curator's room. I am not sure what other accommodation would be required, but if you will give me the dimensions of such room or rooms, I shall be in a position to formulate a scheme to be submitted to the directors of the Institution. I am glad to say that I am getting better, and may be able to occupy some of my leisure time in endeavouring to bring about so desirable an object. We probably may not be able to raise funds enough to carry out all we propose as to internal completion, but we should make the building substantial so as to be able to complete according as funds were forthcoming for the purpose. If you will give me this information, I may perhaps have to ask a question or two upon it before I send you an abstract of my proposals.—Believe me, yours faithfully,

"ALFRED CARPENTER."

To this letter I replied, also *un*-officially, giving my views as to the rooms we should require, and the conditions under which we could probably become tenants. It is proposed that a Sub-Committee be appointed to really consider the question. There is no doubt that in view of certain alterations and enlargements adequate and convenient accommodation could be obtained at the Public Hall, where the work of our Club could be carried on much more satisfactorily and comfortably than at present; but until this suggestion assumes a more definite form, it would be as well not to indulge in anticipations.

In conclusion, I would again urge every individual member to do what he can to help on our Club in what I am sure all will consider good work. Our meetings certainly ought to be better attended, and I wish members would bring specimens to exhibit at those meetings, either to describe for the benefit of others, or to elicit information from others. I would also ask new members, and especially strangers, to put themselves into communication with the Secretaries of the Sections in which they may be interested, in order that they may meet with others who are working at their favourite subjects. We are larger in point of numbers than ever we have been, and we are certainly doing more work: there is no reason at all why we should not go on advancing. Nature is a large field, and Science is boundless: we can never hope to investigate the whole of the one, or fathom the depths of the other; so that, although in the twenty-third year of our existence as a Natural History Society, we are really only just beginning.

Members elected, 1891.

January 21*st.* — Walter T. Barker, Fleetwood, Chepstow Road. P. F. F. Guimaraens, Parkside, Warham Road. Albert Hovenden, jun., Oaklands, Haling Park Road. W. F. Leonard, Holmesdale, London Road. Cecil R. Martyn, The Limes, Thornton Heath, S.E. W. D. Standfast, Elmhurst, St. Peter's Road. Arthur H. Vesey, Chelsea Electric Lighting Company, Chelsea, S.W. A. E. Watson, 7, St. John's Grove. Charles E. L. Watson, 87, Lansdowne Road. Alfred Youngman, Hazeldene, Carshalton Road, Sutton, Surrey.

February 11*th.* — Robert Durham, St. Clair, Addiscombe Road. H. Goschen, Heathfield, Addington. W. H. Goschen, Heathfield, Addington. Ernest Holah, 30, Havelock Road. John Ollis Pelton, Langley, Oakfield Road. George Smith, Ivy Cottage, Brighton Road.

March 11*th.*—F. G. Carey, Kent House, Addiscombe Road. William H. Coldwells, 2, Chestnut Villas, Broad Green Avenue. H. C. Townly, 68, High Street.

April 8*th.*—Charles Hussey, J. P., Park Lane.

May 13*th.* — Alfred Bishop, Ringstead Lodge, Whitehorse Road. William C. Brown, 27, The Waldrons. Albert Crundall, Eastbrook, Park Hill Road. Edward Marriott, Reedham, Purley, Surrey. Leonard Wilde, M.D., Health Office, Katharine Street. A. P. Youle, Olinda, Addiscombe Road.

September 9*th.* — Dr. Henry William Drew, 52, Dingwall Road. Alfred Lambert, Belclare, Ashburton Road. Frank Lloyd, Somerleyton, Haling Park Road. J. Compton Ricketts, Burleigh House, Park Hill Road.

October 14*th.* — R. Percy Bovey, Devon Hyrst, Chepstow Road. William F. Cadell, 14, Canning Road. Edmund G. Dowle, 13, St. John's Grove. James William Murray, 56, Canterbury Road.

November 11*th.*—Brian William Baker, Reedham, Purley. William Henry Brown, 3, Lavender Road, Sutton. Arthur James Norrington, Homeside, Purley. Alfred Ernest Wheelton, Reedham, Purley.

December 9*th.*—John Bottomley, Dohroyd, Birdhurst Rise. George D. Densham, Olden Lodge, Purley. W. H. Dodd, Whitgift Grammar School. Leonard Oakley Grocock, 21, Beckenham Road, Penge.

Library.

The additions to the Library during the year 1891 are as follows:—

From Individuals. — F. C. Bayard: Eocene and Oligocene Beds of Paris Basin (Geologists' Association); Address of President of Royal Meteorological Society, 1890; Rapport sur le Microscope de Sellique (1824); Descriptions des Microscope, de M. Matthieson d'Altona (1834); Rapport sur un Microscope Simple, Seguier (1834); Royal Observatory, Greenwich, On the Value of the Moon's Semi-diameter; Greenwich Astronomical Results, 1856, 1858, and 1873. W. Budgen: Picture-making by Photography; Pictorial Effect in Photography. Dr. A. Carpenter: Journal d'Hygiène, sundry numbers. Walter Crouch, F.Z.S.: On the Land and Fresh-water Mollusca collected in Wanstead and neighbourhood. A. R. Dresser: Six numbers of the Optical Magic Lantern Journal and Photographic Enlarger. Dr. John

Evans: Progress of Archæology. Harry D. Gower: The following papers as issued:—British Journal of Photography; Photographic News; Photography; Amateur Photographer; Photographic Journal; The Camera; Photographic Quarterly; Photographic Reporter; Journal of the Photographic Society of Great Britain; Optical Magic Lantern and Photographic Enlarger; Photographic Art Journal. C. L. Prince: Summary of Meteorological Journal. W. Low Sarjeant: The Camera, Nos. 1—32; Photographic Quarterly, Nos. 1—4. W. Webb: Catalogue of Lepidopterous Insects in Indian Museum, vols. 1 and 2, bound in one.

From Societies.—British Association: Report, 1890; Handbook to Cardiff; Sundry pamphlets. History of Berwickshire Naturalists' Club, 1887—89. La Société Belge de Microscopie: Bulletin, 7me Annèe and Annales, Tome xv. Essex Naturalist, 4 parts. East Kent Natural History Society: Report, 1890. Eastbourne Natural History Society: Transactions, 1889—90. Manchester Microscopical Society: Transactions and Report, 1890. Manchester Geographical Society Journal, 1 part. Northamptonshire Natural History Society Journal, 4 back numbers. Oldham Microscopical Society and Field Club: Journal, 1890. Quekett Microscopical Club: Journal, 2 numbers. Reading Literary and Scientific Society: Report, 1890. Royal Microscopical Society: Journal, 5 numbers. South-Eastern Naturalist: 1 number. West Kent Natural History Society: 3 back Reports.

From Proprietors.—Science Gossip.

Purchased.—Geological Excursions: Norfolk and Norwich Natural History Society, 1 part.

Exhibits, 1891.

January 21*st.*—J. Henry Drage, White-fronted Goose (*Anser albifrons*), taken on Dartmoor.

February 11*th.*—J. Henry Drage, Bewick's Swan (*Cygnus Bewickii*), female, and sternum, showing the characteristic hollow keel and horizontal flexure of the trachea. This bird was shot on reclaimed land at Brading Harbour, Isle of Wight, on 23rd December, 1890. It was only winged, and was kept alive on green refuse and sopped bread until 23rd January, 1891. Length from bill to tail, 3 ft. 10½ in.; stretch of wings, 6 ft. 1 in. Brent Goose (*Anser brenta*), female, shot off Bembridge, Isle of Wight, 20th January, 1891. C. H. Goodman: Nest of wild bees dug out of cliff at Swanage. E. Lovett, Fire-drill from the neighbourhood of Neuchatel, Switzerland; also the smoking outfit of an Indian chief.

March 11*th.*—E. Lovett, Head-dress of bristles from South Africa; Wood bored by *Teredo navalis.*

March 18*th.*—P. Crowley, A series of mimetic Lepidoptera in illustration of Colonel Swinhoe's paper. E. Lovett, Crustacea showing protective colour and development.

April 8*th.*—E. Lovett, to illustrate his paper, Implements, &c., of stone, flint, bone, horn, and bronze; also a model of a Dyak lake-dwelling from Borneo. J. H. Baldock, A translation of 2 vols. of Prof. Heer's work, 'Primæval World of Switzerland.' C. H. Goodman, Ephemera larva, ? sp., taken at Epsom.

May 13*th.*—E. Lovett, A series of volcanic rocks from Mount Vesuvius; and a series of syenites rhyolites, traps, &c., from Jersey,

to illustrate Mr. Teall's paper. F. C. Bayard, Report of the Krakatoa Committee of the Royal Society. N. Waterall, Piece of stone from the Coliseum, and piece of marble from the Forum, Rome.

September 9th.—E. Lovett, Double nest of Great Tit (*Parus major*), and eggs; Stormy Petrels (*Procellaria pelagica*) from the Shetland Isles. H. T. Mennell, Cones of *Araucaria imbricata.* K. McKean, Shells of *Helix obvoluta*, and, under his microscope, jaw of same. C. H. Goodman, Sand-wasp (*Ammophila sabulosa*) and case of dragon-flies, &c. W. M. Holmes, Cocoons and pupæ of goat moth (*Cossus ligniperda*) in wood. E. Straker, Hazel-leaves cut by some insect, with eggs laid on the midrib within the cup formed by the curling of the leaf. John Berney, Living larvæ of the following:—Swallow-tailed moth (*Uropteryx sambucaria*), small tortoise-shell butterfly (*Vanessa urticæ*), sycamore moth (*Acronycta aceris*), waved umber moth (*Hemerophila abruptaria*), buff ermine moth (*Arctia lubricipeda*), brimstone moth (*Rumia cratægata*), grey dagger moth (*Acronycta psi*), poplar hawk moth (*Smerinthus populi*), goat moth (*Cossus ligniperda*), peppered moth (*Amphidasys betularia*), and the large sawfly.

October 14th.—E. B. Sturge, Photographs collected on his recent trip to the United States and Canada. T. D. Aldous, Mummified kitten from Essiout in Egypt, supposed to belong to the period 700 to 900 B.C.

December 9th.—C. F. Oakley, A series of photo-micrographs. J. Weir Brown, Specimens of kallitype printing and a curiously-tinted photograph. T. D. Aldous, A new achromatic objective, one-fifth of a millimetre, by Reichert, of Vienna. E. Lovett, Case of insects illustrating protecting resemblance; a series of crustaceans (*Carcinas mænas*), and a slide showing development of its embryo.

Croydon Microscopical and Natural History Club.—Balance-sheet for the Year ending 31st December, 1891.

Receipts.

	£ s. d.	£ s. d.
Balance at Banker's, 1st January ...	20 9 3	
Cash in hands of Hon. Sec. ...	1 12 6	
		22 1 9
Subscriptions, 1889	0 10 0	
,, 1890	11 0 0	
,, 1891	128 10 0	
,, 1892	6 10 0	
		146 10 0
Sale of Transactions...		0 3 0
Cash received for Hire of Screens ...		0 5 0
Payment in lieu of Notice		0 10 0
Sale of Soirée Tickets		19 7 10
Donations, K. McKean, Esq. ...	5 0 0	
,, J. C. Rickett, Esq. ...	5 0 0	
,, B. Latham, Esq. ...	5 0 0	
		15 0 0
		£203 17 7

Expenditure.

	£ s. d.	£ s. d.
Rent of Club Room		10 0 0
Hire of Rooms for Meetings ...		10 0 0
Printing Transactions, 1889 ...	24 2 4	
,, ,, 1890 ...	24 19 4	
		49 1 8
Insurance		0 18 9
Printing and Stationery		21 16 8
Postages		17 18 11
Meteorol. Sub-Committee Printing Rainfall Returns for the months September, 1890, to November, 1891, inclusive, and sundry Postages		32 7 1
Photographic Sub-Committee ...		2 11 11
Commission on Subscriptions ...		0 15 6
Gratuities		1 6 0
Sundries		2 9 4
Soirée Accounts, 1890		9 18 6
,, ,, 1891		31 8 0
Balance at Bankers	9 19 6	
Cash in hands of Hon. Sec. ...	3 5 9	13 5 3
		£203 17 7

SPECIAL FUND ACCOUNT, 1891.

£210 11s. 8d. CONSOLS.

	£	s.	d.		£	s.	d.
January 1st—Balance from last Account ...	27	2	10	Paid for Notice Board	1	17	6
Dividends—Four at £1 8s. 3d.	5	13	0	Fitting up Dark Room	5	12	4
				Paid for Pressure Gauges	2	13	0
				Balance forward	22	13	0
	£32	15	10		£32	15	10

	£	s.	d.	£	s.	d.
Balance brought down, at Banker's	22	13	0			
Balance General Account	9	19	6			
				32	12	6
Cash in hands of Hon. Sec. ...				3	5	9
				£35	18	3

EDWARD B. STURGE, *Treasurer.*

We, the undersigned, having examined the above Accounts and the Vouchers relating thereto, hereby certify that they are correct, according to the Vouchers and the Banker's Pass Book.

JNO. WEIR-BROWN,
THOS. D. ALDOUS, } *Auditors.*

January 6th, 1892.

LIST OF MEMBERS.

Revised to end of April, 1892.

Date of Election.	
12 Oct. 1887.	Adams, R. Walter, 16 Chepstow-road.
13 Mar. 1889.	Aldous, Thomas Duncan, F.R.M.S., 37 St. Peter's-rd.
10 Dec. 1884.	Allbright, W. J., Broad-green, Croydon.
9 Mar. 1887.	Allder, Joshua, Dunlewey House, Bedford Park.
13 May, 1885.	Allen, Frank, Warrington House, Duppas Hill-road.
9 Aprl. 1884.	Allen, A. H., Leslie Lodge, Lower Addiscombe-road.
14 May, 1890.	Ashcroft, William, Layhams Farm, Beckenham.
11 May, 1887.	Austen, W. V., 18 Belgrave rd., South Norwood, S.E.
19 Mar. 1879.	Backwell, Richard, 1 Tennison-rd., S. Norwood, S.E.
9 Jan. 1889.	Backwell, William Edgar, 1 Tennison-road, South Norwood, S.E.
19 Nov. 1873.	Bailey, Edwin, 10 Lansdowne-road.
4 May, 1870.	Baker, Samuel, Lansdowne-road.
8 Oct. 1890.	Baker, Wm. R., 9 Belmont Villas, Wallington, Surrey.
Original.	Baldiston, Frederick, Ashleigh, Addiscombe-road.
15 Aprl. 1874.	Baldock, J. H., F.C.S., 3 High-st., S. Norwood, S.E.
9 Sept. 1885.	Barber, J. H., 81 London-road.
21 Jan. 1891.	Barker, Walter T., Fleetwood, Chepstow-road.
14 Aprl. 1886.	Barrow, Reuben Vincent, Engadine, Park Hill-road.
8 Feb. 1888.	Bastard, Edward Roger, Highbury House, South Norwood, S.E.
10 Mar. 1886.	Bayard, F. Campbell, LL.M., F.R. Met. Soc., Manor-road, Wallington.
14 Mar. 1888.	Beard, Dr. F., Brighton Road House.
15 Mar. 1871.	Beeby, William H., F.R.M.S., 14 Ridinghouse-street, London, W.
11 Nov. 1885.	Berney, Henry, Chatsworth-road.
Original.	Berney, John, F.R.M.S., Chatsworth-road.
13 May, 1891.	Bishop, Alfred, Ringstead Lodge, White Horse-road.
Original.	Blake, W. J., Elmfield, Park-lane.
14 Oct. 1891.	Bovey, R. Percy, Devon Hyrst, Chepstow-road.
9 Dec. 1891.	Bottomley, John, Dohroyd, Birdhurst Rise.
10 Dec. 1884.	Brebner, G. Reith, M.D., 232 London-road.
15 Dec. 1880.	Brewer, J. G. B., Havelock-road.
11 Apl. 1888.	Brock, Arthur, Chagford, Selhurst-road, S. Norwood, S.E.
19 Feb. 1873.	Brodie, Robert, M.A., George-street.
9 Mar. 1887.	Brooks, W., Laurel Villa, Wray Park, Reigate.
13 May, 1891.	Brown, Wm. Chas., 27 The Waldrons.
11 Nov. 1891.	Brown, Wm. Hy., 3 Lavender-road, Sutton, Surrey.
10 Nov. 1886.	Brown, J. Weir, Ferndean, Heathfield-road.
12 Nov. 1884.	Buckland, John Wellington, 130 Lower Addiscombe-road.
12 Mar. 1890.	Budgen, Walter, 24 Addiscombe-road.
9 Jan. 1889.	Bullock, William C., 20 Dingwall-road.

Date of Election.	
14 Oct. 1891.	Cadell, Wm. F., 14 Canning-road.
11 Mar. 1891.	Carey, Fredk. G., Kent House, Addiscombe-road.
21 Mar. 1877.	Carpenter, A. B., B.A., M.R.C.S., F.R.M.S., Bedford Park.
19 Jan. 1881.	Carter, James A., B.A., Reedham, Purley, Surrey.
10 Sept. 1891.	Carter, Arless H., Reedham, Purley, Surrey.
13 Jan. 1892.	Carter, Francis, High-street, Carshalton, Surrey.
11 Jan. 1888.	Cash, William, Lifford Lodge, Outram-road.
15 Jan. 1874.	Chambers, W. E., J.P., Eversfield, Sutton, Surrey.
11 Aprl. 1888.	Chatterton, George, M.A., M. Inst. C.E., Linton, Grosvenor Hill, Wimbledon, S.W.
15 Dec. 1880.	Cheeswright, F. R., Maythorne, Birdhurst Rise.
16 May, 1877.	Chisholm, Jas., Addiscombe Lodge, Addiscombe-road.
19 Aprl. 1876.	Chumley, John, Worcester Lodge, Canning-road.
10 Dec. 1891.	Church, Robt. W., 50 Birdhurst-road.
10 Dec. 1891.	Clark, Henry, 2 Ventnor Villas, Wadden New-road.
16 May, 1877.	Clarke, Josiah, 88 George-street.
12 Dec. 1888.	Courlander, Louis, 42 North End.
18 Jan. 1882.	Collyer, Henry C., Homewood, Haling Park-road.
21 Oct. 1887.	Collyer, Bryce, Woodlands, Haling Park-road.
11 Mar. 1891.	Coldwells, Wm. H., 22 Montrell-road, Streatham Hill, S.W.
16 Aprl. 1873.	Corry, John, J.P., Rosenheim, Park Hill-road.
14 Dec. 1887.	Couchman, Alfred, Houghton, Birdhurst Rise.
21 May, 1879.	Cowdell, H. S., Cotleigh, West Wickham, Beckenham.
11 Nov. 1885.	Crosfield, G. T., Walden, Coombe-lane.
Original.	Crowley, Philip, F.Z.S., Waddon House.
9 Jan. 1889.	Crowley, Ralph Henry, Bramley Oaks, Bramley Hill.
13 May, 1891.	Crundall, Albert, Eastbrook, Park Hill-road.
20 May, 1874.	Curling, George, Elgin House, Addiscombe-road.
Original.	Cushing, Thos., F.R.A.S., 2 Southside, Chepstow-rd.
10 Dec. 1890.	Cutler, Wm. C., Derwent Bank, Addiscombe-road.
18 Aprl. 1877.	Davies, Arthur Capel, The Glen, Duppas Hill.
9 Dec. 1891.	Densham, G. D., Olden Lodge, Purley, Surrey.
15 Sept. 1875.	Dickinson, William, M.A., F.G.S., Warham-road.
Original.	Dix, T. H., 81 High-street.
9 Dec. 1891.	Dodd, W. H., 9 Coombe-road.
14 Oct. 1891.	Dowle, Edmund G., 13 St. John's-grove.
11 May, 1887.	Down, H. W., Bank Chambers, North End.
9 Jan. 1884.	Drage, John Henry, Tamworth-road.
18 Sept. 1888.	Drage, John, Tamworth-road.
9 Sept. 1891.	Drew, Hy. Wm., Dr., 52 Dingwall-road.
19 Dec. 1877.	Drummond, H., North View, Upper Bridge-rd., Redhill.
18 May, 1887.	Duncan, Peter Thomas, M.D., Park-lane.
11 Feb. 1891.	Durham, Robt., 46 Addiscombe-road.
14 Sept. 1887.	East, Frederick W., Timberham, Horley, Surrey.
16 Aprl. 1879.	Eaton, H. S., M.A., F.R. Met. Soc., Shepton Montague, Castle Cary, Somerset.
4 May, 1870.	Edridge, Sir Thos. R., J.P., The Elms, High-street.
12 Nov. 1890.	Edridge, Fredk. T., J.P., Addiscombe Court.
9 Dec. 1885.	Elborough, C. M., Hazlehurst, Park Hill-road.

Date of Election.	
19 Jan. 1881.	Epps, James, Jun., Norfolk House, Beulah Hill, Upper Norwood, S.E.
21 Feb. 1872.	Fagg, Edward, Beachley, Chichester-road.
9 Jan. 1884.	Falk, Ferdinand, 1 Park Hill-road.
1883.	Fenn, W. G., Heath Lodge, Thornton Heath, S.E.
9 Aprl. 1890.	Field, Edgar A. H., L.D.S., 85 High-street.
14 May, 1890.	Finney, J. A., 57 St. Peter's-road.
9 Mar. 1892.	Flint, Richard, Woodstock House, Park-lane.
12 Nov. 1890.	Fuller, Harry, Hollymount, Duppas Hill.
8 Feb. 1888.	Gaster, Frederick, F.R. Met. Soc., 137 Acre-lane, Brixton, S.W.
13 Mar. 1889.	Gibb, James, 18 Outram-road.
Original.	Gibson, John, 10 Canning-road.
19 Oct. 1881.	Gibson, Walter M., 1a Lower Grosvenor-place, London, S.W.
9 Nov. 1887.	Glazier, J. T., Mavis Bank, Park Hill Rise.
13 Mar. 1889.	Goddard, D. Everett, F.R.M.S., Wallington, Surrey.
9 Feb. 1887.	Goodman, C. H., 9 Dorlcote-rd., Wandsworth Common, S.W.
14 May, 1890.	Goode, Wm., Mulgrave-road, Sutton, Surrey.
11 Feb. 1891.	Goschen, H., Heathfield, Addington.
11 Feb. 1891.	Goschen, W. H., Heathfield, Addington.
14 Jan. 1885.	Gower, Harry Douglas, 16 Wandle-Road.
12 Jan. 1887.	Greenway, Henry, Ulimbali, Ashburton-road.
9 Mar. 1892.	Griffiths, S. L., 340 London-road.
9 Aprl. 1890.	Grimwade, Edwd. H., Orwell House, Campden-road.
9 Dec. 1891.	Grocock, Leonard O., 21 Beckenham-rd., Penge, S.E.
8 Aprl. 1885.	Grundy, Richard F., Fairlie, Morland-road.
18 Jan. 1882.	Guimaraens, P. G., Warham-road.
21 Jan. 1891.	Guimaraens, P. F. F., Parkside, Warham-road.
Original.	Haddock, Roland, 5 The Waldrons.
13 Jan. 1892.	Hall, Joseph, Melton Lodge, Havelock-road.
10 Dec. 1890.	Harland, Arthur F., 32 Park-lane.
18 May, 1881.	Hart, P. S., Lyndhurst, Fairfield-road.
19 Mar. 1879.	Harwood, W. R., Glebelands, Mitcham, Surrey.
14 Mar. 1888.	Helps, James W., Wrangthorn, Stafford-road.
19 Sept. 1877.	Henman, Charles, Streatley, Friend's-road East.
10 Nov. 1886.	Herbert, Hon. Sydney, M.P., 10 Mandeville-place, Manchester-square, London, W.
12 Jan. 1887.	Hinde, Dr. George J., F.G.S., Avondale-road.
9 Aprl. 1890.	Hirst, Arthur Wm., St. Michael's-road.
21 Sept. 1881.	Hobson, J. M., M.D., 65 Lower Addiscombe-road.
12 May, 1886.	Holmes, W. Murton, Glenside, St. Peter's-road.
11 Feb. 1891.	Holah, Ernest, 30 Havelock-road.
10 Dec. 1890.	Hoole, T. G. W., 25 Birdhurst-road.
15 Jan. 1890.	Hopewell, J. M., 79 Lansdowne Gardens.
Original.	Horsley, Henry, M.R.C.S., London-road.
11 Aprl. 1888.	Hovenden, A. Cecil, Arbor End, Selhurst-rd., South Norwood, S.E.
11 Aprl. 1888.	Hovenden, Ernest C., Arbor End, Selhurst-rd., South Norwood, S.E.

Date of Election.	
11 Aprl. 1888.	HOVENDEN, G. S., Arbor End, Selhurst-road, South Norwood, S.E.
16 Feb. 1881.	HOVENDEN, R. G., Heathcote, Park Hill-road.
21 Jan. 1891.	HOVENDEN, ALBERT, Jun., Oaklands, Haling Park-rd.
11 Mar. 1885.	HUGHES, MORGAN, M.R.C.S., L.D.S., Eastbridge, Addiscombe-road.
8 Aprl. 1891.	HUSSEY, CHARLES, J.P., Coombe-road.
17 May, 1871.	INGRAMS, WILLIAM, Whitgift Schools, Church-road.
12 Mar. 1890.	I'ANSON, WILLIAM HENRY, 39 Dingwall-road.
14 May, 1890.	JAMES, H. B., The Oaks, near Carshalton, Surrey.
16 Dec. 1874.	JARRETT, C., 30 St. John's Grove.
9 Mar. 1887.	JOHNSTON, B. McKAY, Katharine-street.
18 Jan. 1882.	JONES, SAMUEL, Trelawney, Addiscombe-road.
16 Feb. 1881.	JUSTICAN, J. W., B.A., Outram-road.
14 Nov. 1888.	KLAASSEN, H. M., Aberfeldy, Campden-road.
10 Jan. 1883.	KÜSTER, GUSTAV, 14 Dingwall-road.
21 Nov. 1877.	LAING, R. A., St. Peter's-road.
9 Sept. 1891.	LAMBERT, ALFRED, Belclare, Ashburton-road.
18 Aprl. 1877.	LANE, HARRY, Havelock-road.
8 Aprl. 1885.	LANFEAR, CECIL, Rockwood, Chichester-road.
Original.	LATHAM, BALDWIN, C. E., 21 Havelock-road.
Original.	LEE, HARRY, 20 St. John's-grove.
13 Aprl. 1892.	LINCOLN, J. G., Wellesley Court-road.
9 Sept. 1891.	LLOYD, FRANK, Somerleyton, Haling Park-road.
11 May, 1892.	LLOYD, ARTHUR, Shirley Hurst, Shirley, Surrey.
8 Oct. 1876.	LOFTUS, T., Outram House, Lower Addiscombe-road.
Original.	LONG, HENRY, 132 High-street.
18 Feb. 1874.	LOVETT, EDWARD, West Burton House, Outram-road.
10 Aprl. 1889.	MAIDLOW, WM. HENRY, Elm Lodge, Park Hill Rise.
13 Mar. 1889.	MANSFIELD, CHARLES, The Lindens, Coombe-road.
10 Mar. 1886.	MARSHALL, ROBERT, Broomfield, The Avenue, Duppas Hill.
8 May, 1889.	MARTIN, HOWARD, Bolney Grange, Havelock-road.
21 Jan. 1891.	MARTYN, CECIL R., The Limes, Thornton Heath, S.E.
13 May, 1891.	MARRIOTT, EDWARD, Reedham, Purley, Surrey.
20 Feb. 1878.	MATHER, C. W., 47 Dingwall-road.
8 Dec. 1886.	MAYLARD, MARTIN W., 86 Lower Addiscombe-road.
Original.	McKEAN, KENNETH, F.L.S., Lloyds, London, E.C.
10 Nov. 1886.	McLACHLAN, ROBERT, F.R.S., F.L.S., 23 Clarendon-rd., Lewisham, S.E.
19 Mar. 1879.	MENNELL, H. T., F.L.S., Park Hill Rise.
18 Jan. 1882.	MILLN, JAMES STOCKS, Cyprus, Chichester-road.
18 Jan. 1882.	MORDAUNT, G., Glenearn, Epsom-road.
21 May, 1873.	MORLAND, CHAS. C., Rastrick Lodge, Morland-road.
14 Nov. 1883.	MORLAND, CHAS. ERNEST, Rastrick Lodge, Morland-rd.
15 Dec. 1880.	MORRIS, A., Beddington Park, near Croydon.
15 Jan. 1890.	MORRIS, J. E., Beddington Park, near Croydon.
9 May, 1888.	MORRIS WILLIAM, C.E., The Kent Waterworks, Deptford, S.E.

Date of Election.	
19 May, 1880.	Morton, Shadforth, M.D., Wellesley Villas, Wellesley-road.
Original.	Muggeridge, T. Benjamin, New Club, Brighton.
14 Oct. 1891.	Murray, James Wm., 56 Canterbury-road.
Original.	Nation, W. J., 40 Thornton-rd., Thornton Heath, S.E.
13 Mar. 1889.	Neall, George, 88 Lower Addiscombe-road.
11 Jan. 1888.	Newman, E. Oakley, 16 Alexandra-road.
11 Nov. 1891.	Norrington, Arthur J., Homeside, Purley, Surrey.
10 Dec. 1890.	Norton, Walter C., Maycourt, Campden-road.
11 Jan. 1888.	Oakley, Charles F., Abbotsford, Sudbury-rd., Thornton Heath, S.E.
18 Feb. 1874.	Oldfield, John, 16 Tamworth-road.
9 Mar. 1892	Packham, James, 16 Katharine-street.
18 May, 1881.	Parsons, H. Franklin, M.D., F.G.S., Oakhyrst, Park Hill Rise.
9 Aprl. 1890.	Patch, Ernest A., The Chestnuts, Havelock-road.
13 Jan. 1892.	Pearl, Surgeon-Genl. Wm., Stuston Lodge, Scole, Norfolk.
9 Oct. 1889.	Pearl, Dr. Edward, Fairoak, Sylvan-rd., Upper Norwood, S.E.
19 Oct. 1870.	Peek, Sir Henry W., Bart., Wimbledon.
9 Dec. 1885.	Perkins-Case, P. W., M.D., 254 London-road.
14 Sept. 1887.	Perry, Archibald H., 6 Friend's-road East.
12 Nov. 1884.	Perry, Edward Seager, 11 Bramley Hill.
17 Jan. 1877.	Pelton, John, Warrington Lodge, Waddon, Surrey.
11 Feb. 1891.	Pelton, John Ollis, Langley, Oakfield-road.
19 Jan. 1881.	Philips, James, Woodlands, Wellesley-grove.
9 Mar. 1892.	Philips, H. Whitby, M.D., Addiscombe-road.
4 May, 1870.	Philpot, Charles W., M.D., Friends' House, Park-lane.
13 Feb. 1889.	Pinnell, Alfred Ernest, Winchester Villa, Carshalton, Surrey.
13 Mar. 1889.	Pittman, J. J., 59 Dingwall-road.
11 Nov. 1885.	Pool, W., 312 London-road, Thornton Heath, S.E.
Original.	Price, George, N., 72 High-street.
14 Sept. 1887.	Prince, James Webster, Brickwood House.
12 Nov. 1890.	Privett, John, 10 South Park Hill-road.
9 Nov. 1887.	Purser, J., 41 Addiscombe-road.
9 Aprl. 1890.	Purser, Fredk. Wm., 41 Addiscombe-road.
21 Jan. 1880.	Pye-Smith, Arnold, Fairfield-road.
14 Jan. 1885.	Read, John Philip, Eversfield, South Park Hill-road.
14 Jan. 1885.	Reed, Lester, F.C.S., F.I.C., Hyrst Hof, South Park Hill-road.
12 Mar. 1890.	Reid, James Christie, 43 Addiscombe-road.
12 Mar. 1890.	Reid, John Johnstone, 4 Sydenham-road.
9 Aprl. 1890.	Reid, St. George C., Brigstock Villa, Thornton Heath, S.E.
15 Sept. 1880.	Rich, Alfred Wm., The Grove, Chatsworth-road.
17 Jan. 1877.	Richardson, T. A., 24 London-road.
9 Sept. 1891.	Rickett, J. Compton, Burleigh House, Park Hill-rd.

Date of Election.	
4 May, 1870.	Ridge, Byron, 112 North End.
19 Dec. 1877.	Robinson, G. E., Lee Villas, Canning-road.
11 Jan. 1888.	Roods, Alford, 35 Derby-road.
21 Oct. 1874.	Rosser, Walter, M.D., Wellesley-road.
12 Mar. 1890.	Russell, Alfred Crake, 60 Clarendon-road.
12 Mar. 1890.	Ryley, Rev. George B., 177 Lower Addiscombe-road.
18 Aprl. 1877.	Rymer, S. L., Wellesley-road.
13 Jan. 1892.	Salmon, Chas. E., Clevelands, Wray Park, Reigate.
13 Jan. 1892.	Salmon, Ernest T., Clevelands, Wray Park, Reigate.
13 Aprl. 1892.	Samson, W. E., 55 Bensham Manor-road, Thornton Heath, S.E.
12 Sept. 1888.	Sandell, John T., Abbotsford, Sudbury-rd., Thornton Heath, S.E.
19 Sept. 1877.	Sarjeant, W. Low, 7 Belgrave-road, S. Norwood, S.E.
14 Jan. 1885.	Saunders, Thomas Dodgson, Twyfordbury, Park Hill Rise.
11 Aprl. 1888.	Schmitz, J. H., J.P., Lansdowne-road.
10 Nov. 1886.	Shearer, Donald, Park Hill House.
13 May, 1885.	Shore, E. L., Millbrook House, Elmwood-road.
10 Dec. 1890.	Shute, Vincent J., 144 Birchanger-road, South Norwood, S.E.
8 Feb. 1888.	Smith, Harold, F.R. Met. Soc., Ingleside, Kenley.
13 Feb. 1884.	Smith, Dr. S. Parsons, Addiscombe-road.
11 Feb. 1891.	Smith, George, Ivy Cottage, Brighton-road.
9 Jan. 1889.	Sparrow, C. H. Burnaby, 1 Chepstow-road.
21 Jan. 1891.	Standfast, W. D., 52 St. Peter's-road.
15 Mar. 1882.	Stanley Joseph, 17 Belgrave-road, S. Norwood, S.E.
Original.	Stanley, W. F., F.G.S., Cumberlow, S. Norwood, S.E.
20 Feb. 1878.	Straker, E., Mareotis, Spencer-road.
11 Jan. 1888.	Streeter, J. S., High-street.
Original.	Sturge, Edward B., The Waldrons.
16 Sept. 1874.	Swaine, J. C., Park Hill-road.
13 Sept. 1882.	Syms, John E., Stanton Villa, Stanton-road.
9 Mar. 1887.	Taylor, Martin, Southbridge-road.
11 Nov. 1885.	Terry, W., Cambourne-road, Sutton, Surrey.
16 Jan. 1878.	Thompson, H. G., M.D., 86 Lower Addiscombe-road.
17 Nov. 1880.	Thompson, Francis, Haling Park-road.
13 Jan. 1892.	Thorpe, Charles, 22 George-street.
17 Nov. 1880.	Topley, Wm., F.R.S., F.G.S., Hurstbourne, Elgin-road.
18 Sept. 1872.	Turner, Henry, 33 Lansdowne-road.
9 Aprl. 1890.	Underhill, Alfred, 23a Clarendon-road.
21 Jan. 1891.	Vesey, Arthur H., Chelsea Electric Lighting Co., Central Station, Chelsea, S.W.
19 Dec. 1877.	Walker, Thomas, C.E., Warrington-rd., Duppas Hill.
10 Sept. 1890.	Waller, D., Jun., Ferndean, Warrington-road.
20 Dec. 1876.	Walton, A., The Homestead, Bedford Park.
19 Sept. 1877.	Warner, A., 2 Grosvenor Villas, Holmesdale-road, Selhurst, S.E.

Date of Election.	
20 Aprl. 1881.	WATERALL, NATHANIEL, Waddon Lodge.
21 Jan. 1891.	WATSON, CHAS. E. L., 87 Lansdowne-road.
15 Jan. 1890.	WAYTE, JOHN, M.D., B.A., 65 Park-lane.
10 Feb. 1892.	WEAVER, H. E. W., 84 Brighton-road.
9 Jan. 1884.	WEBB, W., Jun., Lanoy Cottage, Duppas-road.
15 Jan. 1890.	WEBSTER, EDWIN, 234 South Norwood Hill, S. Norwood, S.E.
17 Oct. 1877.	WENHAM, W. P., Horndean, Waddon Old-road.
10 Dec. 1890.	WENHAM, JAMES, 29 St. John's-grove.
Original.	WEST, FREDERICK, The Waldrons.
17 Mar. 1875.	WHEALLER, G. ANSON, 9 Friend's-road East.
12 Nov. 1890.	WHEALLER, SPENCER E., 9 Friend's-road East.
14 May, 1890.	WILKINSON, C. T., 21 Brighton-road.
9 Nov. 1887.	WILD, A. SCOTT, Canning-road.
12 Dec. 1883.	WILLIAMS, BERTRAM ALEX , L.D.S., 11 Wellesley-road.
12 Aprl. 1882.	WILLOUGHBY, C. W., 28 Friend's-road.
13 Nov. 1889.	WISE, HOWARD R., Beechfield, Bramley-hill.
13 May, 1885.	WITT, S. J., 44 Dingwall-road.
17 May, 1871.	WOODWARD, JOHN, 21 Canning-road.
12 Oct. 1887.	WRATTEN, F. C. L., 42 Canterbury-road.
12 Oct. 1887.	WRATTEN, SIDNEY HERBERT, 42 Canterbury-road.
13 May, 1891.	YOULE, A. P., Olinda, Addiscombe-road.
9 Sept. 1885.	YOUNG, JOHN WOOD, 1 Wellesley-grove.
21 Jan. 1891.	YOUNGMAN, ALFRED, Hazelden, Carshalton-rd., Sutton, Surrey.
12 Mar. 1890.	YUILL, CHARLES J. M., Marion Villa, Addiscombe-rd.

Honorary Members.

9 Sept. 1885.	BERNEY, FREDERICK LEE, Ravensbourne, Tambo, Queensland, Australia.
10 Mar. 1886.	CAMERON, Capt. V. LOVETT, R.N., C.B., 7 Great George-street, Westminster, S.W.
21 Aprl. 1875.	COLE, R. BEVERLEY, M.D., San Francisco, California, U.S.A.
16 Aprl. 1879.	EVANS, JOHN, D.C.L., F.R.S., Hemel-Hempstead, Herts.
16 Aprl. 1879.	FLOWER, W. H., LL.D., F.R.S., Natural History Museum, South Kensington, London, S.W,
16 Aprl. 1879.	PRESTWICH, Prof. JOSEPH, Shoreham, Sevenoaks, Kent.
11 Jan. 1888.	SYMONS, G. J., F.R.S., 62 Camden-square, N.W.

Associates.

20 Aprl. 1881.	COLLYER, EDWARD B., Selsdon-road.
11 Nov. 1885.	RODBOURN, J.

TRANSACTIONS

OF

THE CROYDON MICROSCOPICAL AND NATURAL HISTORY CLUB.

1891–2.

93.—Respiration of Insects.

By C. H. Goodman.

(Read March 11th, 1891.)

In dealing with this comprehensive subject this evening it will be necessary to omit all reference to the theory of respiration in general, and proceed at once to examine the methods by which it is effected. Assuming therefore that you recognise the necessity of bringing the oxygen of the atmosphere into contact with the blood so as to vitalise every structure in the body, we will first notice the modes adopted in the different groups of the Arthropoda. This is seen in the following table :—

Crustacea	in the lower—cutaneous. but mostly—branchiate.
Arachnida, either ...	cutaneous. branchiate. tracheate.
Myriopoda	tracheate.
Insecta	tracheate.

Here a gradual development is seen, the Insecta attaining the highest position.

The general plan of the tracheal system, as found in insects, may be said to consist of two main tubes extending down either side of the body, often united at intervals by connecting ones. Smaller branches ramify from every part in all directions, gradually dwindling away as they penetrate further, and spread over every organ. Lateral branches from the main tubes, or tracheæ, lead to the external surface, where air is inspired

through openings called spiracles. In some cases in the Myriopoda each spiracle has its own separate tracheal system, but this is seldom the case with the class we have to consider. These tracheæ consist of two thin membranes, between which is coiled a spiral thread, thus affording the necessary flexibility and firmness. The inner membrane is an invagination of the outer cuticle, so that when a moult takes place a part at all events of the tracheæ is shed at the same time. Empty pupal skins may occasionally be found floating on ponds with the greater part of the trachea still visible, testifying to the deep reaching nature of the metamorphosis.

An idea of the distribution of the tracheæ in the wings of insects may easily be gained by observing the nervures, each of which carries a branch, and which also assist in unfolding and spreading those organs on emergence from the pupa state. In the legs, too, they may sometimes be traced without much preparation, and it is instructive to observe the way they are enlarged in the neighbourhood of the auditory organ in the tibia of crickets. The way the tracheæ envelop the ganglia and alimentary canal of the wasp are also well shown in the slides exhibited. Closely connected with the tracheæ are certain dilatations, found in flying insects, and called air-sacs. You will notice that the structure is of a different character, and that the spiral thread of the tracheæ is discontinued. A consequence of this is that they collapse when the air is withdrawn, and it is owing to their necessary inflation before rising from the ground that the apparently leisurely spread of the wings and elytra of the stag-beetle is due before a start is effected.

In *Corethra plumicornis*, the phantom larva, you will observe two pairs of conspicuous spotted sacs, which, Prof. Rymer Jones states, eventually burst and produce a tracheal system. In most of the Diptera, two large air-sacs may be found occupying a considerable part of the abdomen.

Coming now to the stigmata or spiracles, great variety exists in number, form, and position; and it should be noted that this variation often extends to the larva and imago of the same insect. From one to ten pairs may be found, nine being a very common allowance, while in aquatic larvæ they are reduced to a minimum. In shape they are either circular, oval, crescentic, triangular, reniform, &c. As a rule, the thoracic spiracles are the largest, although *Dytiscus* is a conspicuous exception. The general position is down the sides, often in the soft integument connecting each segment; they are conspicuous in many of the lepidopterous larvæ. Occasionally they are ventral, as in some Hemiptera, but more often dorsal. In the common water-boatman (*Notonecta*) a further admirable arrangement must be noticed. The diagram shows a section of the abdomen, and the

spiracles are placed at the foot of the raised ridge on either side. From the top a horizontal line of hairs stretches towards a similar row from the raised median ridge, thus forming two air-chambers to supply the stigmata, and permit a prolonged stay under water. In this case the spiracles are really ventral, though, as the creature always swims on its back, they are practically on the upper surface.

A similar result is produced among many aquatic Coleoptera by the cavity formed by the elytra, which can often be seen being replenished as the creature brings the tip of its abdomen to the surface.

In the Hydrophili we find part of the under side clothed with pubescence, which retains the air, thus rendering it somewhat difficult for them to get to the bottom of the water; *H. piceus* in this group gathers in the air with its antennæ, bringing its head to the surface for this purpose.

To guard against the entrance of dirt or foreign matters into the tracheæ, the spiracles are protected by hairs, spiculæ, ridges, or sieve-like coverings, of which I show four examples.

A curious modification of spiracle can be seen in *Nepa*, the familiar water-scorpion. Here it is anal, and composed of a long projecting tube; but, as great danger would arise from its getting stopped up, Nature has provided that it shall be made in two halves, with the sides fringed with hairs, which interlock; they can then be readily separated, and any impurities removed. In *Eristalis* a long tube is provided, but in this case it is telescopic, being capable of protrusion for a considerable length.

The muscular apparatus by which spiracles can be closed is composed of four parts—the bow, the lip, the lever, and the muscle; and is thus described by Huxley:—"The bow is a thickening of one-half of the circumference of the chitinous lining. The lip is formed by the other half of the circumference, and the lever is a chitinous process connected with one end of the bow or with the lip. When the lever is single the muscle, which is attached to it, passes over the lip, and is inserted into the opposite end of the bow. When it contracts it therefore presses the lip against the bow. When two levers are present they are attached to opposite ends of the lip and bow, and the muscle extends between their extremities. The effect of its contraction is to thrust the free edge of the lip against the bow."

That something more is necessary than the mere presence of air in the tracheæ is evident, and it is to the largely developed muscular system we must look for a means of circulation. When a wasp alights on a fence you must all have observed the contraction and expansion of the abdomen. With each pulsation the process of expiration and inspiration is effected, and it will be readily understood that if the spiracles were closed after an

inspiration the effect would be to drive the air up the trachea, though it is probably owing to what is known as the diffusion of gases that the supply is renewed in the finer extremities. It is in the thorax that the larger spiracles occur, and it is through them that the buzzing sound is chiefly produced. Small chambers have been found in some insects behind the spiracle at the entrance of the trachea, and it seems probable that the vibration of certain chitinous processes in this locality have much to do with it. The muscles of the wings are attached to the thorax, and not to the wings themselves; consequently, as the capacity of the thorax is altered with every flap of the wings, respiration is effected at the same time, the more rapid the flight the quicker the breathing.

We have now lastly to examine those methods by which respiration is carried on where no spiracles exist. The number of insects thus provided is comparatively few, and they are all aquatic larvæ breathing by means of branchiæ, although they are not so highly developed as those with spiracles. I have left them till the last for the clearer understanding of the subject. I must, however, mention that there are some few insects known to science which possess both branchiæ and spiracles at the same time, and I regret I have been unable to get an illustration for you, though one at least is a British insect. Such forms are particularly interesting to the evolutionist as examples of an intermediate transitional stage.

We will take that of *Agrion* first, as being the most common and almost always to be found. The tail is seen to be composed of three leaf-like flaps attached to the last segment. The microscope shows them to be ramified by tracheæ, and it is by asmotic action through their thin tissue that the air is supplied to the tracheæ. Another common form is the little white bunch of filaments seen on either side of the head in *Chironomus plumosus*, the cast-skins of which are often found floating on ponds, and make beautiful opaque objects with the side reflector. Each slender filament carries its own trachea.

The Ephemeridæ furnish many interesting species in their larval condition. One of the commonest (a species of *Boetis*) has seven pairs of oval laminate gills, articulated at the end to the hinder edge of each segment of the abdomen. It is abundant in the Hogsmill River at Ewell. *Ephemera vulgata* has six pairs of bifurcate plumose gills. I have found their cast-skins by thousands in the Basingstoke Canal in May. Another species (probably *Clæon dipterum*) has its branchiæ of a fan-shape, double, a smaller in front of a larger, and on the dorsal margin of the abdomen. In this species, which I have taken at Epsom, the tracheæ were most distinct. In other instances the specimens may have been younger, as they frequently are not developed

until the first or second moult, as previous to this they breathe cutaneously.

It must be clearly understood that these organs are not strictly branchiæ, such as exist in the Crustacea, and in which venous blood circulates, but tracheo-branchiæ, the air contained in the water being absorbed through their substance, and taken by the numerous tracheæ radiating through them.

Another form of gill is that of the larvæ called caddis-worms, in which rows of short isolated threads extend along the body. *Sialis*, the common little black-veined fly found by streams, supplies another form of larval branchiæ. Here seven pairs of fine jointed tapering arms of some length project laterally, down which the tracheæ with their numerous little branches may easily be detected. When alarmed the creature directs them slightly upward, and they appear comparatively rigid; they are equally useful for swimming backwards or forwards.

Lastly, there is the enlarged rectum found in the *Libellula*, with its ridges and rows of short leafy processes. In this case, as in the others, the same structure serves for locomotion and respiration. By the muscular contraction of the cavity the effete water is driven out, and, when suddenly exerted, propels the insect a considerable distance.

Thus we see that the methods of respiration are very varied and very instructive. In all cases the method adopted is the one best adapted to the requirements of the individual. I do not profess to have shown you more than a passing glimpse of this aspect of insect life, and have selected those examples I have met with and are most familiar rather than those which are most curious or uncommon.

94.—Notes on the Prehistoric Lake Dwellings of Switzerland.

By Edward Lovett.

(Read April 8th, 1891.)

The Lake Dwellings of Switzerland have attracted much attention amongst ethnologists, owing partly to the great number of relics found in the lake deposits, and also to the very great interest that surrounds the remarkable people who lived during that early period. The name of Keller stands pre-eminent as an authority upon the subject, but numerous writers have contributed to the bibliography of this very absorbing topic.

I do not intend to-night to do more than briefly describe the conditions under which the implements were found, the conditions under which we have reason to suppose they were made, and the illustrations they afford us of the origin of recent implements and appliances, as well as the state of the community or communities who fashioned them, made the pile villages, and lived in them.

Many years ago, the accidental discovery of some curious stone axes, which happened to come before the notice of a man who knew what they were, and did not share the popular opinion that such things were thunderbolts, led to the systematic investigation of the old lake-beds of Switzerland, and of such shores of recent lakes from which the water had retired, as well as to the dredging of such waters as could not be otherwise examined. The results, extending over a long time, have been the discovery of a large number of piles marking the sites of these ancient settlements, and an enormous mass of material in the shape of relics of one sort and another, from which a pretty general idea of the people who constructed these houses has been obtained.

To be brief, these piles indicated that all the villages or groups of huts were built over the water, probably on one common platform, and that each group or platform was connected with the shore by a causeway, also on piles. Again, it was found that, taking a section of the deposits, piles were found with their points in the mud, but above the heads of other piles, showing that fresh settlements have been reared above the *débris* of the old ones; and as so much of all the material found has been charred, there is reason to believe that the villages were frequently destroyed by fire. The curious thing about the investigation of these deposits is that it shows that there is a regular sequence of marked ages; for in the very lowest deposits stone is the material of all implements of hardness, though horn and bone were used; a little higher up the stone is of a more finished type, whilst still nearer the surface bronze occurs not only in vast and highly finished condition, but almost to the exclusion of stone; from which it would appear as though there was a great gap between the two periods, as very probably there was. But, to crown all, Roman remains in iron occur plentifully over the surface mud, though no record exists of the Romans having knowledge of these lake dwellings. No doubt the Roman relics which occur there have no connection whatever with the relics of the lake people, any more than the 16th century smoking pipes which are found mixed up with the Roman remains have anything to do with *them;* or than the relics of mediæval, Roman, and bronze-age times which are brought up sometimes from the bed of the Thames in one haul of the dredge have anything to do with each other.

Such dwellings are by no means confined to Switzerland,

though the completeness of discoveries there has put other similar finds into the background. Such aquatic settlements have been traced near water in many parts of the Continent, from the mound-like villages of Friesland to the morass houses of Roumania; and in Ireland and Scotland they existed, and the remains are described as Crannoges; whilst in the Holderness district of Yorkshire recent excavations have revealed pile dwellings and weapons very like the Swiss examples; and I am myself inclined to think that our own River Thames, when it was much wider, and covered the low grounds of, say, the Erith district, had in its shallows several of these curious old pile villages, for many of the stone and bone implements sometimes dredged up are very like the Swiss forms. For modern examples we have only to read of the water-houses of the great African lakes, and the shore pile-dwellings of the water Dyaks.

As to the people who inhabited these curious houses, and who made the varied assortment of implements, by which alone we can judge of them: who can tell with certainty what they were, and whence they came? As regards their condition socially, we can form some idea from the data to be obtained from the investigation of the Swiss lake relics. Probably these pile-dwellings sheltered an industrious and inoffensive race to whom we owe much of what we know and possess to-day. That they were fishermen is certain, for not only have numerous fish remains been found among these relics, but fish-hooks of bone and horn and stone of the earlier period, and of well-finished bronze in the later. They were also hunters, as is shown by the remains of a variety of animals known to us as *game*, and by the existence of such weapons as would be used in the chase. In all probability, they kept cattle and dogs, the former of course on the mainland; perhaps they were the originators of domesticating these and other animals. They also grew grain and fruit, as the charred remains of these objects testify, and in this they may have been the first *real* cultivators of the soil. The charred netting found in the peat-bed shows exactly the same knot as is now used, and who can say that it was not invented by them?

In connection with the age of stone, little or nothing has been found of an ornamental or decorative character, but in the overlying deposit with bronze objects a decided evidence of art exists, an art, too, which is in its way superior to many similar examples even of our time. Was this art latent in the period before the discovery of bronze, and did it suddenly burst out when suitable material was obtainable upon which to display it; or were these bronze-age people another race altogether? At all events we can only conclude, even from the examination of a small collection as the one before you is, that the primitive lake-dwellers of Switzerland were a remarkable people; that,

considering all things, they made a marvellous use of the materials at their disposal; that they were a hard-working and industrious race, to whom we probably owe much, and that they possessed an originality of design in their bronze ornaments so good, that we are quite content in our boasted high state of art and taste to copy the forms which they created.

95.—On Cossus ligniperda.

By W. Murton Holmes.

(Read September 9th, 1891.)

About two years ago, as I was walking in the public recreation ground at Faversham, in Kent, the strong odour of the goat-moth larva (so named from its supposed resemblance to the odour of the he-goat) greeted my nostrils, and caused me to endeavour to discover the spot from which it emanated. This proved to be an Italian poplar, and, with the help of the gardener, who brought a ladder, we found a large number of the larvæ, in various stages of growth, under the bark. As, however, none of them were full-grown, and I did not want the trouble of keeping them for a year or two, I asked the gardener to let them remain until the tree was cut down, which the inroads of the caterpillars had rendered inevitable. Last autumn I received from him, by post, a cardboard-box containing upwards of twenty of them, and the writhing mass that presented itself when the box was opened was, to say the least, remarkable,—so was the smell. Fortunately they had not been too long in transit, as they had almost eaten their way out. Had they escaped whilst in the custody of the Post Office, the feeling and exclamations of the officials, more especially of the lady clerks, may be imagined but not described. There is some difficulty in keeping them securely, owing to the facility with which they escape from any ordinary box. I placed mine in a bell-glass aquarium with a heavy glass cover, which answered perfectly. I put in several pieces of decayed wood, and in the course of a few days they had all gnawed their way inside.

The caterpillars are by no means pleasant objects to look at, or to handle. They are about three or four inches long, somewhat flattened, and with powerful jaws, and are of a mahogany colour along the back, becoming gradually paler on the sides and under surface, with a few hairs scattered over the body. Looked at from a little distance, they appear like animated pieces of raw

beef-steak. Their odour is alike powerful and persistent. They feed upon the sap-wood of the willow, poplar, ash, and elm, and are three or four years in developing to the perfect insect. Towards the winter of each year they spin themselves up into a soft cocoon, and remain in a torpid state until the warm weather returns, and the sap begins to flow. *Apropos* of sap, there was some exuding from their burrows in the poplar tree when I saw it, which seemed to be very attractive to several red admiral butterflies. The caterpillar does not change into a chrysalis until a short time before it is hatched, which takes place in July and August. The chrysalis is furnished with a series of toothed projections on the edges of each of the segments, which enable it to work its way along the burrows, and, when the time arrives for it to change into the perfect insect, it pushes itself for about half its length through the bark, so that the moth emerges in the open air.

For collections it is necessary to kill the moth, which is of a brown and grey colour, as soon as the wings are fully developed, as, being a heavy moth and a strong flyer, it is soon damaged. The female moth is remarkable for possessing a well-developed ovipositor, which enables the insect to deposit its eggs in the clefts and crevices of the bark.

One other English moth, the wood leopard, the larvæ of which bore into wood, is also furnished with a similar ovipositor. The caterpillars are very destructive to the trees upon which they feed. I have known of several large trees infested by them having to be cut down, and an avenue of poplars, leading to the house of a friend of mine, was entirely destroyed by their ravages.

96.—The Sand-wasp.

By Charles H. Goodman.

(Read September 9th, 1891.)

While staying in the South of Devon, at the end of September, I had the opportunity of watching the habits of the sand-wasp (*Ammophila sabulosa*). Their burrows are not uncommon in a soft sandy bank in the cliff facing the sea at Budleigh Salterton, and when the sun is shining they may be seen rapidly running about enjoying the warmth.

On one occasion I saw a fine specimen alight near its tunnel with a large legless grub about an inch long. Leaving its prey outside it quickly entered its nest, and returned, but not before the grub had rolled about eighteen inches to the foot of the bank.

The sand-wasp, missing its treasure, began to hunt up and down the bank, but she passed twice within two inches of the grub without seeing it. I replaced it after a minute or two on the spot from which it fell. It was now quickly found, and, seizing it by her powerful mandibles, she endeavoured to get it down the narrow entrance. Failing in this attempt, she let go for a moment to alter her arrangement, when alas! the grub fell down the bank a second time. Again she appeared unable to discover it until it was replaced; but now, firmly grasping it near the head, and with its body between her legs, rapidly disappeared backwards into her nest.

97.—Double Nest of Great Tit, Parus major.

By Edward Lovett.

(Read September 9th, 1891.)

In my garden at Addiscombe is an old Roman mill or quorn of siliceous conglomerate, which stands upon a large ornamental flower-pot, inverted, so that the hole in the quorn corresponds with the aperture in the base of the flower-pot. The whole rests on the ground under the shadow of a spreading apple-tree.

In the spring of 1888 I observed a pair of great tits (*Parus major*) busy near the quorn, and was pleased to discover that the whole of the lower area of the flower-pot was occupied by a nest of these birds, and that it contained nine eggs. In due course the young birds were hatched, and, when fledged and ready to fly, I was surprised to find that the attempt to get through the hole in their ceiling had resulted in the death of two and serious damage to a third, the upper mandible and scalp being badly broken. I mention this as I always considered that these birds never built in localities from which the young could not be extracted. However, I released the remainder of the brood in safety.

About the same time the following year the same or another pair of the same birds again built in the quorn, the number of eggs on this occasion being eight; seven of these hatched, and were liberated when ready to fly, as the same difficulty as to getting out of their prison presented itself.

Last year (1890) the birds came again, and nine eggs were laid and hatched, but unfortunately, when the young were half-grown, my cat killed one (perhaps both) of the parent birds, and, although I did all I could for the young ones, they died after

two days and a half. This spring I was greatly delighted to see a pair of the same birds (probably the young of 1888 or 1889) again building in the same old place; and I took every precaution to protect the birds from the cat, but unfortunately without success, and the nest was again deserted.

Upon examining the now tenantless nest I was surprised to find that instead of one hollow in the centre, as formerly had been the case, there were two depressions or nest cavities near the sides of the nest. In one of these were four eggs, and in the other two. I had examined the nest ten days previously, and there were then neither eggs nor depressions therein. Upon careful examination I noticed that the four eggs in one cavity were evidently one clutch or set, whilst the two in the other cavity were different in shade and size of the specks of colour, and evidently not laid by the same hen. It frequently happens that if one bird loses a mate, it takes to itself another, and this has been known to occur repeatedly, one cock taking hen after hen to supply the place made vacant by his successive mates being shot. In the present instance, however, I do not see how this could have been the case, as all the six eggs were certainly laid in ten days, and there is no reason why they should not have all been placed in one nest cavity, except there were two pairs of birds nesting in one spot, which I believe to be the real fact of the case. The cat probably killed one bird of each pair, though I only saw one dead bird; or the attack of the cat so alarmed the other birds that they deserted the nest.

This remarkable double nest is on the table for inspection, and I hope, and fully believe, that in spite of past failures and trouble, the old Roman mill will next spring be again tenanted by a pair of *Parus major*.

98.—The Storm Petrel, Procellaria pelagica, used in the Orkneys, Shetlands, and St. Kilda as Candles.

By Edward Lovett.

(Read September 9th, 1891.)

In collecting material and data bearing upon the subject of primitive fire-making and light-giving or holding appliances, I came across some of an exceedingly interesting character connected with the various islands north of Scotland. Amongst these was the use of the whelk-shell, *Buccinum undatum*, as a lamp with whale oil; crude lamps hollowed out of solid stone; and perhaps the most wonderful candle ever heard of, namely,

the storm petrels, simply dried, and a string inserted for a wick, the exceedingly fatty nature of the birds causing them to be adaptable to this purpose.

The following note, which I came across amongst some miscellaneous jottings, bears out what at first seemed difficult to believe:—"Dr. H. Labourne mentions a curious peculiarity of the stormy petrel, which has caused it to be styled the lamp-bird by the fishermen of the island of St. Kilda. The flesh of the bird is very oily, and the inhabitants of the island, who kill it by thousands, utilise this property for domestic purposes; they insert a wick in the bird's bill, and obtain for an hour a light that is sufficiently bright to serve their purposes."

For a long time I tried in vain to get any specimens to illustrate this curious use of the bird, nor could I hear of any one who had so seen them in use. This was owing to the fact that in *nearly* all the islands, if not in all, the practice has died out in favour of a better lighting appliance. At length I met with a native of the Orkneys who seemed well acquainted with the islands, and, although he himself had never seen the birds in use, he appeared to know of some older men who had, and he obtained for me some of the birds which I now exhibit, showing how they were used for giving light.

My correspondent also furnished me with some curious particulars regarding these birds; which he detailed in a very quaint manner. One was that the petrel birds come on shore in July to hatch, but are not seen at any other time. Another was that when he got them for me he said "it was no joke to get them petrels, as they have to be dug deep out of the earth." This sounds a paradox, but it refers to the fact that the birds build at the end of long burrows made in the loose earth capping the rocks and cliffs. When sending the birds he remarked that he had no time to insert a string, so I could do that myself; and he further stated that the birds were alive in his possession, but that he killed them before sending, as they were such perishable things.

99.—Mimicry in Nature.

(A Lecture delivered by Colonel Charles Swinhoe, F.L.S., at the Public Hall, Croydon, on Wednesday, March 18th, 1891.)

The subject of this evening's lecture is Mimicry in Nature, by which I mean the extraordinary resemblance Nature has brought about in the course of ages, by very slow degrees, of a creature to its surroundings, so that it may become hidden and lost to the

eye, and thus be protected from its enemies. The subject can be divided into Aggressive Resemblance, Protective Resemblance, Warning Colours, and True Mimicry. I am going, however, to-night to show you, by some exhibits with the magic lantern, examples of protective mimicry only, *i.e.*, protective resemblance, where, by its likeness to its surroundings, the creature becomes protected; and secondly, true mimicry where animals that are tasteful and greedily devoured by their enemies become protected by their resemblance to others of a distasteful nature that are not eaten, and in whose company they live. Most of my exhibits to-night refer to insects, and a few to crustacea; and Mr. Lovett, the President of the Club, and Mr. Crowley, the Past-President, have very kindly brought a quantity of specimens of the creatures themselves.

For very many years collectors have observed, and from time to time have brought to notice, the extraordinary resemblance one creature bears to another with which it is in no way related; this is especially the case with insects. Nearly thirty-five years ago, Prof. Westwood, the eminent entomologist, described in the 'Transactions of the Linnean Society' a grasshopper, which he called *Condylodera tricondeloides*, as bearing a remarkable resemblance to a tiger beetle of the family *Cicindelidæ*, a most pugnacious group, called *Colluris crassicornis*. Now, if you come to think of it, this grasshopper must have had a most remarkable resemblance to a tiger beetle to have taken in an eminent entomologist like the Professor, in whose collection, he tells me, this grasshopper remained in the row of these tiger beetles for four or five years before, after careful examination, he discovered it was not a beetle at all, but a grasshopper. Of course the theory of mimicry had not been started then, and cases of this kind were looked upon as curiosities, and phenomena of Nature.

Another very good case in point is the wonderful resemblance the female of *Hypolimnas mysippus* bears to the common distasteful Indian *Danais*, in whose company it lives; the resemblance is so perfect, it is only within recent years we find this insect in collections, for the simple reason that collectors do not catch the *Danais*, it is so common; while the female of *H. mysippus* on the wing is not distinguishable from the common *Danais* to the ordinary collector. I well remember the first time I myself saw this insect; it was at Winchester, some twelve years ago, in the collection of a schoolboy; it was in a row of the common Indian *Danais* someone had given him. He very kindly gave me the insect, and I have it now. Mr. Bates was the first who started the theory of the unconscious mimicry of one species for another for protection from its enemies, in an admirable paper in the 'Transactions of the Linnean Society' in 1862; and subsequently Mr. Wallace, a close observer of Nature,

who collected for some years in the Malay Archipelago, a region most fertile in mimetic examples, brought very many remarkable facts on the subject to the notice of the scientific world. Since then much has been written on the subject, not by mere collectors and cabinet-naturalists, but by really scientific observers working in the field, like the great Charles Darwin, Bates in the Valley of the Amazon, Wallace in the Malay Archipelago, Trimen in South Africa, and, in Europe, Meldola, Fritz Müller, Wiseman, Poulton, and others.

Now as to protective resemblance. Everyone knows that there are plenty of butterflies and moths that bear a most remarkable resemblance to their surroundings; this applies to all orders of insects, to birds, beasts, and fishes, and it naturally suggests itself to the thinking mind that Nature has brought about these resemblances for the protection of the creatures so coloured and marked: creatures that live in the sand are coloured of the same hue as the sand; those living in the grass are green; and so on, with some remarkable exceptions of brightly-coloured animals, that from many experiments have been found to be so extremely nasty, hardly anything will touch them. These come under the head of warning colours, with which I am not dealing to-night. There are some butterflies that so exactly resemble the leaves they settle on as to become lost to sight as soon as they alight, such as the *Kallima machis*, the common leaf butterfly of India, my first exhibit. It is greedily devoured by many kinds of birds and reptiles, and would be soon exterminated if Nature had not protected it by its great resemblance to the leaves it goes to rest upon. The second exhibit is the common lappet moth of England (*Gastropacha quercifolia*), on a deal board, which, I need hardly say, is not his proper resting place, and also amongst oak-leaves; you can see how perfectly well it is protected by its resemblance to the leaves. You may touch him, and he will drop amongst the leaves he so resembles, and there he will stop. The next exhibit has reference to some experiments that were made by Mrs. Barber with chrysalids of *Papilio nerius*, an American butterfly. This lady obtained these caterpillars, and tried them on different kinds of leaves. The result was that those on the leaves of an orange tree became a bright green, as shown in the exhibit, just like the leaves of the tree; another was placed on a different kind of plant having withered yellow leaves, and was absolutely of quite a different colour to the first one, and more closely resembling the colour of its leaves. Amongst these caterpillars was one which escaped, and could not be found; but the next day they found that it had gone away and turned into a chrysalis on the lid of a box, and was of exactly the same colour as the lid. These were all from the eggs of one mother, and therefore it is a perfectly fair experiment. Those that

turned chrysalis on green leaves became green, those that turned on withered yellow leaves became of a withered yellow colour, and the one that escaped and turned chrysalis on the lid of a box is of exactly the same colour as the lid.

The next examples are in reference to some experiments of my own in India. At one time I collected the larvæ of a hawk moth on several occasions, and I found them sometimes bright green, and sometimes red, and could not account for it. I obtained some eggs of this moth (*Panacra vigil*), and fed the half of them on *Cissus*, which is pink, and the others on *Calladium*, which is green, and, though a hot-house plant here, is very common in India. Those fed on *Cissus* became pink, while those fed on the green leaves of the *Calladium* became green. I was then under the mistaken impression that the colouring matter of the food plants gave the colouring to the caterpillars; but since then many experiments have been made by others, and I am quite convinced I was mistaken. The food plants can have nothing or very little to do with it; it is nothing more or less than the surroundings.

Mr. Poulton has made several experiments in this direction with a number of caterpillars. He had a box made with a number of divisions, and near the bottom of the divisions were a certain number of holes. He then tied a number of caterpillars so that half were in one division and half in the other, one of the divisions being painted black, another red, and so on. Of course this was a very uncomfortable position for the caterpillars, and some died. However, some lived, and in every case the chrysalis was of the colour of the surroundings in the direction of which it was tied. No doubt it is the nervous system through which they acquire the coloration of their surroundings, and it appears to me that when a caterpillar turns into a chrysalis, the the last thing his eyes rest on causes the colour of the chrysalis.

Now the next example is the cocoon of the common English emperor moth. This is also the result of some more experiments made by Mr. Poulton. These caterpillars spin a silk cocoon, inside which is the chrysalis. One spun in a black bag, and produced a black cocoon; while another of the same insects, and of the same family, spun its cocoon on a sheet of white writing-paper. The result was that every bit of the silk was perfectly white. It is very difficult indeed to account for the reason of it. Of course one only draws deductions as to the manner in which Nature has brought about these extraordinary facts that a cocoon should be white on white paper, and black in a black bag, in resemblance to the surroundings. How it is done is a mystery, and we must wait some years yet till it is elucidated.

My next example is that of a spider in lichen. The spider makes its home right in the middle of the lichen, waiting for its

prey. But this is not an aggressive resemblance only, but a protective one, because it is very good food, greedily devoured, and it obtains protection from its extraordinary likeness to its surroundings.

The next example is from life of the pipe-fish (*Siphonostoma typhle*). This creature obtains its protection by being coloured like the grass amongst which it lives, *Zostera*, a grass-like flowering plant which is found in the sea, like sea-weed. The pipe-fish stands up in it like a piece of grass, and sways backwards and forwards with the current in the same way as the grass. This example is taken from life from the Plymouth Aquarium. An interesting example of adventitious protection is afforded by certain crabs (*Stenorhynchus*, an English spider-crab), which fasten pieces of sea-weed on their bodies and limbs. Some of these may be observed in the cases your President has been good enough to bring; the exhibits were taken from life in the Plymouth Aquarium, and I think very fairly represent the creatures themselves. Mr. Poulton tells us in his book on the colours of animals that Mr. Bateson has observed the process. The crab takes a piece of sea-weed in his two chelæ, and without either snatching or biting it, deliberately tears it in half as a man tears paper with his hands. He then puts one end of it in his mouth, and chews it up, presumably to soften it. He then takes it out, and rubs it firmly on his head or legs until it is caught by the peculiar curled hairs which cover them. If the piece of weed is not caught by the hairs, the crab puts it back in his mouth and chews it up again. The whole process is very human and purposeful. This crab is a very favourite food for some fish, and, as your President has just reminded me, the fish never eat sponges, these creatures cover themselves with sea-weed and sponges, so that they can thus be hidden by something which their own enemies object to.

Next we come to true mimicry, where one creature is protected by its resemblance to another. The general observation of all the writers on this subject is that imitating species are comparatively rare, often very rare, whilst the imitated are to be found in great numbers, the two living together; the imitated are protected species, being distasteful, whereas the imitating are good food, and would become exterminated but for the protection they obtain by being lost in the crowd of those they resemble. I will confine my exhibits to butterflies, with which I am most familiar, and whose structural characters and habits I have studied for years. There are butterflies that, by many experiments, have been found to be good food, and to be greedily devoured by birds and lizards, and such creatures as prey on them; and are protected by their resemblance to others that, also by many experiments, have been proved to be of a

distasteful kind, and, as a rule, are not eaten by birds or reptiles.

The butterflies of the genus *Danais* are a very good example of distasteful creatures, and they are mostly in great numbers. For my own part, I have never seen them attacked; and I remember some four years ago Mr. E. H. Aitken had some pet lizards in Bombay, and he was very sceptical as to the *Danais* being so distasteful as to be refused by creatures when hungry, and he said he would make his lizards eat them. He therefore kept them for five days without food, and then, in the ordinary way of feeding them, he threw some live *Danais* into their cage. They greedily ran to them, and it was quite comical to see the way they stopped as soon as they got to them, threw up their heads and walked away as if disgusted, and would not touch them; and Meldola notes that in a neglected collection of butterflies the mites will eat everything but the *Danais*, and mites cannot be called dainty creatures.

There are two kinds of so-called mimicry; one where vast quantities of distasteful butterflies of different genera and species keep to the same colour and pattern, the other—the true mimicry—where tasteful butterflies that would otherwise fall an easy prey and become exterminated are protected by the extraordinary resemblance to the distasteful ones. I think the term "mimicry" has been rather abused. It is perhaps unfortunate that some better term has not been invented to express the resemblance Nature has brought about in the course of ages, by very slow degrees, of one creature for another for protection, just in the same manner as Nature has brought about the resemblance of creatures to their surroundings; because the word mimicry in its ordinary sense means conscious imitation, whereas the word as now used means nothing of the sort; but it is obviously absurd to apply the term mimicry to cases where creatures that are all protected by being distasteful resemble one another.

We find that the protected species are always plentiful, mostly in great numbers, and they live in countries in various groups of patterns; but when the systematist comes to examine any group in large numbers, he finds, to his astonishment, that they are not all alike—that there are in each group many species, and even many subgenera. To call this mimicry is misleading; if the subject be thought out, the only conclusion we can come to is that it could not be otherwise. Undoubtedly each group of the same pattern came from one common ancestor, and it is obvious that whatever changes have taken place in the course of time, it was necessary for their better protection to maintain the well-known distasteful pattern. At all events, there was no necessity for changing it, and where changes have been going on

in the structural characters in different localities to adapt the creatures to their changes in their surroundings, the general pattern has been maintained, while the changes in structure in some instances have been so great as to form new subgenera in the systematic lists. For example, I show in this exhibit six butterflies of *Danais* of one pattern from various parts of India, all of different subgenera. Although of one similar pattern, they vary much in shape, and more particularly in the sexual characters of the males. *Tirimala* (India) has a large scent-pouch or sac between the median and submedian veins; *Radena exprompta* (Ceylon) has none; *Parantica agrea* (S. India) has the scent producing organs on both median and submedian veins; and *Bahora philomela* (West Java) and *Asthysa melanoleuca* (S. Andamans) have the same; but in *Asthysa* the scent-pouch on the submedian vein is rudimentary, and they all differ more or less in shape and form. *Caduga larissa* (Java) has the scent-pouches on the submedian aud internal veins. In another example are eight *Euplocus* of one pattern, but of eight different subgenera, from different parts of India and the Malay Peninsula, which also, though of very similar pattern, vary much in structural and sexual characters. These insects are so wonderfully alike in pattern, it was not until so recently as 1883, when Mr. F. Moore wrote his great Monograph on the *Linninana* and *Euploema* in the 'Proceedings of the Zoological Society,' explaining their structural differences, that their subgeneric distinctions have been properly understood.

There are many distasteful butterflies mimicked by others for protection, but the *Jancussæ* are the commonest in the Old World; and after I had the good fortune to listen to Mr. Poulton's great lecture on Mimicry at the last British Association Meeting at Leeds, it struck me it would be a good thing to follow any one mimetic species all over the different countries inhabited by it, and see the result. Now in the genus *Hypolimnas* or *Diadema*, though according to systematists there are many species, there are from a biological point of view practically only two distinct species, *H. mysippus* and *H. bolina*, and I therefore determined to follow them, and the result I must say has astonished me.

First we will deal with *H. mysippus*. The female is somewhat similar to the female of *H. bolina*, but it is a smaller insect; the white spots on the wings above are larger, rounder, and without any blue; and the under side has a reddish hue, not present in *H. bolina*, and on the wing it is a far more active insect. The male, so far as we know, is able to protect itself, and is never mimetic; but if you cripple one and let it go, it soon falls a prey to the first insect, bird, or reptile that sees it. Its female is invariably mimetic, being a slow flier, and a conspicuous object;

when heavily laden with eggs, it would soon become exterminated if not protected by Nature in some way or other. This female invariably mimics the commonest of all the *Danainæ*, i. e., *D. chrysippus*, which is common all over India, Burmah, Ceylon, the Malay Archipelago, Madagascar, Aden, and, in Africa, in the west, south, and south-eastern coasts; and in every one of these localities *H. mysippus* also exists, the female being of the *Danais* colour and pattern; and where the *Danais* does not exist, *H. mysippus* is not to be found. In Africa, *D. chrysippus* is of a dull bronzy red, and not nearly so brightly coloured as it is in Asia; and similarly the females of *H. mysippus* in Africa are of a dull bronzy hue, whereas in India the females are brighter coloured, like the hue of the Indian *Danais*. In Africa and at Aden there are two or three forms of *D. chrysippus*, some without the black patch to the fore wings, some with it, but with white hind wings, and some without it, also with white hind wings, and in their places are occasionally to be found females of *H. mysippus* similarly marked and coloured. In India the mimetic form of the *Danais* without the black patch is also occasionally to be found, and so also is the *Danais*, but the mimicker is commoner than the mimicked. I am inclined to believe that this is the more ancient form, but is dying out and is gradually being replaced by the black-tipped form, and that the mimetic form has actually outlasted the form it has mimicked. There is proof of this in the species *H. bolina*, examples of which I will give later on. It will be seen from the exhibits that there are examples of *H. mysippus* mimicking *D. chrysippus*, *D. alcippus* and *D. dorippus*.

Next we come to the species *H. bolina*. In Asia the female only is mimetic, the male in all localities being of the normal form. The female universally mimics *Euplæa* of the *core* pattern, where these exist; and wherever *core* is the common form, the mimic is invariably of the true *core* pattern. The exhibit shows *H. bolina* and *E. core*. But *E. core* does not go very far south; one or two have been taken in Mergui, but there is no record of its more southern existence. In Amboina it mimics *E. climena*. In one of the Solomon Islands you get the normal male just as we have it in India, and the female in the form of the commonest *Euplæa* of the place. In another island called Meleita, quite close by, both male and female imitate the common *Euplæa* of the district, and this is one of the most beautiful mimetic forms you can find. The male mimics the male, and the female the female, imitating the common noxious and most plentiful butterfly of the district in which it lives. Yet a little farther, go to Ké Island, and here we find *H. bolina* mimicking *E. hopperii*. In Sumatra it imitates *E. singapura*. In fact, you may follow it wherever you will, and wherever it is found it is always in the garb of the commonest butterfly of the district. Then we come

to the Fiji Islands, where we get a transitional form. There seems to be here a regular mimetic gradation from a brown to a yellow *Euplœa.* We do not know much at present of the Lepidoptera of the Fiji Islands, but I can show you one or two of the *Euplœa,* and Mr. Crowley in his magnificent collection has several. You can get them in the transitional stage there from the *Danais* to the *Euplœa.* From the Celebes, to my astonishment, I have got the female of *H. bolina* in a mimetic form resembling a male *Danais,* and these came in an ordinary collection I received from the Celebes through Herr Sniller, the well-known Dutch lepidopterist. From here we go to Africa.

In Africa we find both sexes of *H. bolina* mimicking various kinds of *Danainæ,* and consequently from a systematist's point of view, having lost their specific characters, they bear many specific names. In search of the mimetic form of this most extraordinary species I looked over Mr. Crowley's magnificent collection; I also went over the collection of Mr. F. Moore, Mr. Godman, Mr. Druce, and of the British Museum, besides my own, and I must say the result is most extraordinary. In every district, the south, west, and east, and I dare say in many places in the interior, you get this extraordinary insect in a new garb, coloured and marked—though structurally the same—in the garb of the common noxious *Eupleus* of the district. I might have brought at least a hundred different specimens to-day. But I have selected three, not that they show better mimicry than the others, for in every locality where the forms occur the mimicry seems to be remarkably good; but these show more or less different patterns, and are from such widely different localities as Natal, in the south-east, and the Cameroons, in the west, of Africa:—*H. marginalis,* protected by its resemblance to the *Danais* (*Amauris*) *dominicas* from Delawur; *H. mima,* protected by its resemblance to *Danais* (*Amauris*) *echeria* from Graham's Town; *H. dubia,* protected by its resemblance to *Danais* (*Amauris*) *egialea* from the Cameroons.

I know there are many people who will still continue to pooh-pooh the whole theory of mimicry. The theory was only started in 1862; volumes have been written about it since then: many eminent men have done so, and people still continue to reject it. Only last summer a very eminent Professor, for whom in every other matter I have the most profound respect, told me that his silk umbrella was of a mimetic character, that it was gradually assuming the appearance of a cotton umbrella to escape being stolen. It is all very well to laugh at the theory, but it is an undoubted fact that these things are. You have followed to-night one species all over the Old World, and you find it nowhere but in the garb or disguise of the common noxious insect of the district. It is nowhere but in that disguise, and wherever the

noxious creature has become exterminated there it has become exterminated also. It is obviously absurd to suggest as merely phenomenal coincidences such cases as these, when certain creatures only exist under mimetic forms, which vary in colour and pattern according to the colour and pattern of the distasteful creature in every locality where they exist together.

In conclusion, I wish to point out that I have only been trying to show you some of the extraordinary cases of protective mimicry; but as to how the thing is brought about, no one can say, because nobody knows; all that one can do is to observe Nature closely, and make deductions. That Nature is always working for the protection and preservation of the creatures it contains I think our common sense tells us. The key-note of the whole theory of evolution which the great Charles Darwin brought to light is the great struggle for life which is always going on around us, the survival, in fact, of the fittest. And the more one thinks, and the more one observes, the more you become impressed with our own extreme insignificance, and with the wonders of the work of the great Creator.

100.—Gelatino-Chloride Papers.

By Edw. Marriott.

(Read before the Photographic Section, October 2nd, 1891).

During the past four or five years the sale of gelatino-chloride paper has increased wonderfully: four years ago it was very little known amongst amateur photographers. In Germany it is extremely popular, and in America the demand for it is enormous. At last our English manufacturers are waking up to the fact that there are trade possibilities in this line, and we need no longer send to Germany for our supplies, and Mr. J. Fallowfield, the Blackfriars Co., and the Ilford Co., are producing it.

Two years ago, as far as I can make out, there were only two kinds on the market. To-night I have prints from seven kinds for your inspection: Obernetter, Leisegang, Aristotype, Celerotype, Fallowfield's, R. Talbot's, Adams' Luminotype, and the Ilford Paper. I print them rather deeply, and without any washing the prints are transferred to the combined toning and fixing bath. I have had no experience with any other bath, although equally good results are obtained by their use. I know that the one I use works well, keeps well, and will tone any paper or transparency that requires it. I have with me two lantern slides to show the difference in colour produced by this

bath. We are informed that the addition of chloride of gold to hypochloride must give rise to sulphur compounds, and therefore sulphuration of prints must follow. I am not chemist enough to discuss this point, but experience ranks before theory, and I never get this sulphuration, except from thoroughly exhausted baths; when yellowing appears it is time to make up a fresh bath or add gold. Experts are unable to decide how it is that albumen prints toned in such old-fashioned baths as sel d'or (sulphur toning notwithstanding) retain their beauty for years, while modern alkaline baths fail to yield this permanency. Perhaps the heavier silvering of bygone days played its part, and in the gelatino-chloride paper the conditions are somewhat analogous, as with this process we can print from more vigorous negatives, get a denser deposit of silver upon the print, and reduce gold upon the image to an extent impossible to modern albumen paper, without fear of over-toning. When the prints in the bath have nearly reached the required tint they are removed to clean water and well washed for two or three hours in several changes of water. I thoroughly wash glass, celluloid, enamelled iron, or ebonite; if glass, I dry it, and rub a little talc over it with a soft rag. When I wish to be especially careful, I put both print and glass under water to exclude all air. The print is then squeezed down, and, when satisfied that all air-bubbles are removed, the print with its support combination is set on one side to dry; excessive heat must not be used, or the prints will resist all efforts to remove them in a whole condition. They will not leave their support until they are quite dry, and, with me, seldom fall off. I generally raise one corner and pull them off. I keep pieces of celluloid in a stone jar, they are covered with water, free from dust, and always ready.

In Matt-surfacing, proceed exactly in the same way as with enamelling, only use a ground surface instead of a polished one. If the prints are to be mounted with starch, they should be backed whilst damp, and in contact with the support. To save this operation many dealers keep a spirit or naphtha mountant, but I have not tried any of these. White shellac dissolved in methylated spirit, and strained through fine muslin, will, I believe, act well as a mountant. Several of the prints exhibited were mounted with a mixture of glue and methylated spirit, but as this is only an idea of my own, and has not been tested long enough, I do not advise it. Used carefully it does not injure the surface of the print.

101.—THE REPORT OF THE METEOROLOGICAL SUB-COMMITTEE FOR 1891.

PREPARED BY THE HON. SEC. FRANCIS CAMPBELL BAYARD, LL.M., F.R. MET. SOC.

THE arrangements for observing the daily rainfall round Croydon have been successfully carried out on the same plan as last year. The staff numbers 49 observers, superintending 57 stations, as against 45 observers and 53 stations in 1890.

Several changes have occurred during the year. The old established station of Reigate Hill will in future become a monthly one, instead of a daily one, owing to the removal of the observer into Reigate, and its place on our printed list will be taken by a new station, the College, Caterham Valley, the accession of which is most welcome. The old station at Grange Road, Sutton, comes to an end, owing to the death of the observer early in January. A new station appears for the first time in that of Oakfield Road, Croydon. Owing to the removal of Dr. H. Franklin Parsons into Croydon, his observations at South Norwood came to an end, but Dr. B. N. Dalton has very kindly offered to continue them at his house at South Norwood, and though not strictly a continuation, the observations are taken at a spot sufficiently near to enable the Sub-Committee to put them in the daily list. With respect to New Malden, there is a break of five months, owing to the departure of the engineer, Mr. T. L. Heward; the station, however, is now resumed under the superintendence of Mr. T. V. H. Davison. The stations of Croydon (Limes Road), Esher (West End), Sydenham, and Eltham have been discontinued, owing to the removal of the observers; but the Sub-Committee have much pleasure in announcing that the places of these stations will be taken by, they hope, one at Oxshott, one at Wandsworth Common, and by the old-established station at Woolwich resuming daily observations.

Appendix I. to this Report contains a list of the observers, with particulars relating to the stations and gauges. The stations with the asterisk prefixed were admitted after the commencement of the year, and the three with the double asterisk are stations which sent in reports in the previous year.

Appendix II. contains the tables of daily rainfall issued monthly, and subsequently stereotyped.

Appendix III. gives the monthly rainfall of six other stations.

Appendix IV. gives a record of all falls of rain of 1 inch

and upwards in the 24 hours, extracted from Appendices II. and III.

And, finally, Appendix V. contains general notes on the characteristic features of every month.

The observations are taken at 9 a.m. at all the stations, except at Addington (Park Farm), and Brixton 8 a.m., Bickley 9.30 a.m., and Croydon (Limes Road), South Norwood, and Kew 10 a.m.

With reference to the rainfall of the year, the Sub-Committee find it very difficult to come to any definite conclusion. Comparing it with 1890, it appears an extremely wet year, but when it is looked at more closely there is rather a different tale. The first six months of the year were comparatively dry, and the last six months wet, the amount falling in the last months ranging from $1\frac{3}{4}$ to $\frac{3}{4}$ in. excess of the amount falling in the first six months. It is, however, by comparing the year with the averages of previous years that we must decide whether the year has been wet or dry. At Greenwich the year closed with an excess of ·52 in. over the 50 years 1841—90 average, and was the wettest year since 1888; at Surbiton it closed with an excess of 3·20 in. over the 35 years 1856—90, and was the wettest year since 1880; at Kew it closed with an excess of 2·36 in. over the 35 years 1856—90, and was the wettest year since 1885; at Brixton it closed with an excess of 3·00 in. over the 20 years 1871—90, and was the wettest year since 1880; at Beckenham it closed with a defect of ·78 in. on the 20 years 1871—90, and was the wettest year since 1888; at Addiscombe (Outram Road) it closed with an excess of 3·93 in. on the 15 years 1876—90, and was the wettest year since 1880; and at Sutton it closed with an excess of 5·69 in. on the 10 years 1881—90, and was the wettest year since 1880. We may therefore fairly, the Sub-Committee think, come to the conclusion that the year was a wet one, though not to any very great extent, the probability being that the excess was not much more than 1 in. over the average of a long series of years. With respect to the time at which the rain fell, we all know what miserable weather we had for our holidays; but even this was not without its corresponding advantages, for these rains filled up the underground springs, and instead of a great scarcity of water, which was expected by nearly everyone about October, we got through scatheless, and now the springs are well filled, and there is, your Sub-Committee trust, no fear of a scarcity of water during this present year. The Sub-Committee, however, cannot contemplate without apprehension the continuous pumping up of the under-ground waters for the supply of our large towns, and are fully aware of the prejudicial effects that this must eventually have on the public health, and would impress on all public authorities the necessity,

which will year by year become more urgent, of endeavouring to find out means of preserving some of the waters which now run to waste, and using them as a primary supply, reserving the under-ground waters for an emergency.

The number of days on which 1·00 in. and upwards fell is larger than in 1890, but the amount of the largest fall is much smaller, being only 1·95 in. as against 2·62 in. in 1890.

In conclusion, the Sub-Committee ventures to ask the aid of every member of the Club in aiding them in their work.

APPENDIX I.

No.	Stations.	Observers.	Size of Gauge.	Height of Gauge above Ground.	Height of Gauge above Sea-level.
	SURREY—		IN.	FT. IN.	FT.
	Dorking (Denbies)	J. Beesley	5	0 6	610
	Reigate Hill (Lovelands)	R. Binns	5	1 3	600
	Caterham (Metropolitan Asylum)	G. S. Elliott, M.D.	5	1 0	610
	*Caterham Valley (The College)	C. W. Rudd	5	1 0	500
	KENT—				
5	**Knockholt (The Beeches)	W. Morris, C.E.	5	1 0	785
	SURREY—				
	Marden Park (Birchwood House)	C. & F. Rutley	5	1 0	471
	Kenley (Ingleside)	Harold Smith	8	1 0	375
	Purley (Reedham Asylum)	J. A. Carter	5	1 0	375
	Purley (Tudor Cottages)	J. Bonwick	5	1 0	216
10	Banstead (The Larches)	Rev. C. J. Taylor	8	1 0	488
	Ashtead (D'Abernon Chase)	Sir W. Vincent, Bart.	5	1 0	300
	Sutton (Mulgrave Road)	W. Goode	5	5 6	230
	**Sutton (Grange Road)	late W. Thurtell	5	1 6	230
	Carshalton (The Wrythe)	J. W. Manley	5	4 10	107
15	Wallington (Manor Road)	F. C. Bayard	5	4 1	157
	Beddington (Riverside)	S. Rostron	5	1 0	120
	Waddon (Waddon House)	P. Crowley	5	1 0	156
	Croydon (Brimstone Barn)	Croydon Corporation	5	1 0	130
	*Croydon (Oakfield Road)	A. Malden	5	1 6	478
20	Croydon (Limes Road)	Croydon Corporation	5	1 0	195
	Croydon (Whitgift School)	A. E. Watson	5	1 0	191
	Addiscombe (Havelock Road)	Baldwin Latham, C.E.	8	1 0	205
	Addiscombe (Outram Road)	E. Mawley	8	0 9	202
	Addington Hills (The Reservoir)	Croydon Corporation	8	0 9	473
25	Addington (Park Farm)	W. Whalley	5	1 0	268
	Addington (Pumping Station)	Croydon Corporation	8	1 0	331
	KENT—				
	West Wickham (Layham's Farm)	W. Ashcroft	5	1 0	500
	Hayes Common (The Warren)	Miss Akers	5	1 0	296
	Keston (Bradfield)	A. Hill	5	1 0	350
30	Keston (Heathfield)	Miss M. Holland	5	0 6	420
	Keston (Tower Fields)	G. Buchanan, C.E.	8	0 9	351
	Orpington (Kent Waterworks)	W. Morris, C.E.	5	1 0	220
	Farningham Hill	A. J. Waring	5	3 0	300
	Wilmington (Kent Waterworks)	W. Morris, C.E.	5	1 0	25
35	Chislehurst (The Chestnuts)	J. B. Snell	5	1 0	325
	Bickley (Highfield)	J. Batten	5	1 2	295
	Beckenham (Foxgrove)	P. Bicknell	5	0 6	142
	SURREY—				
	South Norwood (Whitworth Road)	H. F. Parsons, M.D.	5	1 2	200
	*South Norwood (Selhurst Road)	B. N. Dalton, M.D.	5	1 0	210
40	Wimbledon (Sewerage Works)	C. H. Cooper, C.E.	5	1 0	58
	Wimbledon (Mount Ararat)	T. Devas	12	3 0	157
	Raynes Park (Pumping Station)	C. H. Cooper, C.E.	5	1 0	47
	New Malden (Sewerage Works)	T. L. Heward T. V. H. Davison, C.E.	5	1 0	45
	Esher (Sewerage Works)	Baldwin Latham, C.E.	5	1 0	40
45	Surbiton (Seething Wells)	R. Hack, C.E.	10	0 6	25
	Kingston (Sewerage Works)	T. Stevens	5	1 0	25
	Richmond (Ormond Lodge)	J. T. Billett	5	0 9	51
	Kew (Kew Observatory)	The Kew Committee	11	1 9	19
	Brixton (Acre Lane)	F. Gaster	8	1 0	77
50	West Norwood (Thornlaw Road)	W. Marriott	8	1 0	220
	KENT—				
	Sydenham (Longton Grove)	M. J. Porter	8	4 6	220
	Forest Hill (Dartmouth Road)	Mrs. Behrens	5	1 0	220
	*Forest Hill (The Nurseries)	James Carter & Co.	6	0 6	76
	Deptford (Kent Waterworks)	W. Morris, C.E.	5	1 0	20
55	Greenwich (Royal Observatory)	The Astronomer Royal	8	0 5	155
	**Woolwich (Shooter's Hill)	Capt. S. D. Cleeve, R.E.	5	1 0	352
	Eltham (Victoria Road)	Capt. M. S. Richardson, R.E.	5	1 0	205

APPENDIX II.

Daily Rainfall. January, 1891.

Day of Month	Dorking	ReigateHil	Caterham	Marden Park	Kenley	Purley (Reedham)	Purley (Tudor C.)	Banstead	Ashtead	Sutton	Carshalton	Wallington	Bedding-ton	Waddon	Croydon (Brim. Bn.)	Croydon (Limes Rd.)	Croydon (Whitgift)	Addiscmb. (Hvlk. Rd.)	Addiscmb. (Outm. Rd.)	Addington Hills	Addington (Park Fm.)	Addington (Pump. St.)	West Wickham	Hayes Common	Keston (Bradfield)
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
3	·11	·39	·15	·14	·10	·17	·15	·13	·15	·17	·19	·18	·14	·16	·14	·15	·15	·19	·14	·15	·04	·15	·15	·14	·13
4	..	..	..	·03	·01	·02	..	·02	..	·01	..	·01	..	..	..	·01	..	..	·01	..	·03	·02	..	·01	·02
5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..
6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
7	·10	·16	..	·03	·07	·05	·04	·09	·05	·07	·07	·02	·06	·08	·09	·11	·11	·05	·06	·07	·08	·05	·06	·07	·08
8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
9	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
11	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
12	·02	·20	..	·02	·05	·07	·07	·04	·10	·05	·02	·03	·01	·02	..	·03	·02	·02	·03	·05	·02	·04	..	·05	·07
13	..	·03	..	..	·04	..	..	·03	..	·02	..	·03	..	·02	..	·01	..	..	·02	·02	·03	·01	..	·02	·04
14	..	..	..	..	..	..	..	..	..	..	·02	..	..	..	..	..	..	..	..	..	..	..	..	..	..
15	·10	·07	..	·03	·04	·08	·10	·09	·12	·09	·05	·08	·04	·07	·10	·08	·08	·08	·08	·07	·13	·07	·06	·05	·05
16	..	·05	·10	·05	·03	·03	·03	·03	..	..	..	·01	·01	·02	·06	·01	·03	·02	·04	..	·06	·04	·01	..	·02
17	..	·02	..	·07	·05	·03	·03	·05	..	·05	·05	·02	·03	·03	·03	·02	·02	·03	·03	·04	·03	·03	·03	·05	·06
18	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
19	·06	..	..	..	·02	·01	..	..	..	..	..	·01	..	..	..	..	..	·01	..	..	..	..	..	..	·01
20	·25	·71	·16	·28	·25	·19	·22	·17	·33	·22	·21	·25	·17	·16	·20	·24	·21	·20	·22	·23	·25	·25	·28	·29	·16
21	..	..	..	..	..	..	..	..	..	..	·01	·01	..	..	..	..	..	..	·01	..	..	·02	..	·04	·01
22	·05	·01	..	·01	·02	..	·02	..	..	..	..	·01	..	·02	..	·01	·01	·02	·01	·01	·02	·01	·03	·02	·02
23	·25	·35	·48	·28	·25	·17	·20	·15	·15	·15	·13	·15	·33	·15	·16	·18	·14	·17	·16	·18	·22	·20	..	·17	·13
24	·31	·26	·22	·26	·31	·24	·26	·24	·32	·25	·22	·24	·25	·23	·24	·20	·25	·24	·24	·24	·26	·27	·58	·32	·19
25	..	..	..	·01	·01	·01	·02	..	..	..	..	..	·01	..	..	·01	..	..	·01	..	·01	..	..	·01	..
26	·02	·02	..	·02	·02	·02	·02	·02	..	..	..	·01	..	·01	..	·01	..	..	·01	·01	·01	·01	..	·01	·01
27	·05	·09	·18	·12	·08	·02	·05	·03	·04	·03	..	·02	·02	·02	·02	·02	·02	·05	·03	·05	·06	·05	·13	·04	·05
28	·25	·31	·27	·16	·25	·17	·17	·15	·10	·09	·10	·10	·10	·09	·06	·12	·10	·10	·10	·09	·11	·12	·17	·11	·11
29	·73	·78	·76	·64	·72	·52	·61	·48	·38	·33	·27	·39	·36	·36	·28	·29	·36	·35	·34	·39	·56	·52	·51	·40	·40
30	·41	·35	·36	·32	·47	·41	·48	·40	·44	·37	·40	·42	·42	·45	·42	·42	·44	·41	·41	·40	·42	·34	·36	·37	·31
31	·30	·20	·10	·22	·27	·22	·24	·23	·20	·21	·17	·18	·16	·16	·14	·14	·16	·16	·16	·18	·18	·18	·23	·17	·18
Total	3·01	4·00	2·78	2·69	3·04	2·43	2·71	2·35	2·38	2·11	1·91	2·17	2.11	2·05	1·94	2·06	2·10	2·10	2·11	2·18	2·52	2·38	2·60	2·35	2·05
From Jan. 1	3·01	4·00	2·78	2·69	3·04	2·43	2·71	2·35	2·38	2·11	1·91	2·17	2·11	2·05	1·94	2·06	2·10	2·10	2·11	2·18	2·52	2·38	2·60	2·35	2·05

Daily Rainfall. **January, 1891.**

Day of Month	Keston (Heathfd.)	Keston (Tow. Fds.)	Orpington	Farningham Hill	Wilmington	Chislehurst	Bickley	Beckenham	South Norwood	Wimbledon (Sew. Wks.)	Wimbledon (Mt. Ararat)	Raynes Park	New Malden	Esher	Surbiton	Kingston	Richmond	Kew	Brixton	West Norwood	Sydenham	Forest Hill	Deptford	Greenwich	Eltham
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
2	..	..	..	..	..	..	..	..	..	·01	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..
3	·12	·13	·13	·10	·08	·07	·12	·08	..	·10	·15	·16	·39	·01	·18	..	·15	·10	·12	·13	..	·10	·10	·09	·01
4	·02	·01	..	·02	..	·01	..	..	..	·02	..	·01	..	·04	..	..	·01	..	·01	..	..	..	..	..	..
5	..	..	..	..	..	·02	..	..	..	..	..	..	..	..	..	·20	..	..	..	..	..	..	..	..	..
6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
7	·06	·07	..	·08	·05	·09	·09	·03	·20	·05	·05	·06	·04	·02	·05	..	·06	·04	·04	·05	·19	·09	·03	·07	·07
8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
9	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·05	..	..	..	..	..	..	..	..	..
10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
11	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	..	..
12	·06	·05	·04	·05	·01	·01	·03	·02	..	..	..	·03	..	·01	..	..	..	..	..	·02	..	·01	..	·01	..
13	·03	·03	·03	·02	·02	·01	..	·02	..	·02	..	·02	·02	·02	·02	..	..	·01	·02	·02	..	·02	·02	·01	..
14	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	..	..	..	..
15	·06	·06	·07	·04	·05	·10	..	·05	·10	·07	·10	·09	·07	·06	·09	·01	·11	·07	·07	·08	·05	·04	·04	·05	·13
16	·04	·04	..	..	..	·04	·12	·02	..	..	..	·02	..	..	..	..	..	..	·01	..	..	·06	·01	·04	·10
17	·06	·07	·03	·05	·03	·05	·09	·02	..	·01	..	·02	..	..	..	·09	..	..	·02	..	·09	..	·01	·03	·03
18	..	..	..	..	..	..	..	..	..	·02	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..
19	·01	..	..	..	..	..	..	·01	·02	·01	..	..	..	..	..	..	·01	·01	·01	·02	..	..	..	..	..
20	·23	·23	·22	·25	·21	·20	·25	·19	·20	·21	·24	·26	·22	·17	·23	..	·17	·16	·18	·18	·26	·10	·19	·17	·26
21	..	..	..	·02	·02	·04	..	..	..	..	..	..	..	·02	..	..	..	..	..	..	..	..	·01	·01	·02
22	·03	·03	..	..	·01	..	..	·01	·03	·01	..	·02	..	·01	..	·23	·01	..	·04	·05	·02	..	·01	·01	..
23	·22	·20	·18	·12	·14	·21	·19	·16	·16	·13	·14	·16	·14	·14	·16	..	·18	·17	·19	·13	·19	·14	·17	·14	·19
24	·26	·26	·23	·18	·18	·22	·22	·20	·21	·25	·27	·28	·24	·16	·27	..	·22	·21	·27	·22	·25	·26	·22	·23	·21
25	..	..	..	·01	·01	·01	..	..	..	..	..	..	..	..	..	·17	..	·01	..	..	..	..	..	..	..
26	·02	..	..	..	·02	..	·01	..	..	..	..	·01	..	..	..	·26	..	..	·01	..	..	..	..	..	..
27	·09	·09	·09	·08	·04	·04	·04	·02	·02	·01	..	·02	..	·01	..	..	·01	..	·02	·02	..	·02	·01	·01	·03
28	·17	·14	·14	·15	·05	·07	·08	·05	·08	·08	·10	·09	·09	·06	·13	..	·09	·07	·10	·06	·07	·0[illegible]	·07	·07	·06
29	·48	·65	·37	·37	·19	·29	·28	·20	·23	·21	·25	·25	·19	·09	·26	·01	·27	·24	·24	·21	·22	·21	·22	·24	·21
30	·35	·35	·31	·31	·23	·29	·35	·33	·38	·27	·30	·32	·27	·26	·36	·16	·42	·44	·31	·29	·32	·28	·29	·31	·29
31	·21	·20	·19	·15	·13	·12	·11	·10	·12	·09	·10	·12	·06	·05	·07	·30	·07	·06	·09	·08	·09	·10	·08	·07	·09
Total	2·52	2·61	2·03	2·00	1·47	1·89	1·98	1·51	1·75	1·57	1·70	1·94	1·73	1·14	1·82	1·49	1·78	1·60	1·75	1·56	1·76	1·49	1·51	1·56	1·70
From Jan. 1	2·52	2·61	2·03	2·00	1·47	1·89	1·98	1·51	1·75	1·57	1·70	1·94	1·73	1·14	1·82	1·49	1·78	1·60	1·75	1·56	1·76	1·49	1·51	1·56	1·70

Daily Rainfall.

February, 1891.

Day of Month	Dorking	ReigateHill	Caterham	Marden Park	Kenley	Purley (Reedham)	Purley (Tudor C.)	Banstead	Ashtead	Sutton	Carshalton	Wallington	Bedding-ton	Waddon	Croydon (Brim. Bn.)	Croydon (Limes Rd.)	Croydon (Whitgift)	Addiscmb. (Hvlk. Rd.)	Addiscmb. (Outm. Rd.)	Addington Hills	Addington (Park Fm.	Addington (Pump. St.)	West Wickham	Hayes Common	Keston (Bradfield)
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	·02	..	·01	..	..	·02	..	·04	..	·01	·01	..	..	..	..	..	..	·01	..	..	·01	..	·01	..
2	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·02	..	..	..	·01
3	..	..	·13	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..
4	..	..	..	..	..	·01	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
6	..	·01	·03	·02	·02	·01	·02	·01	..	·01	..	·01	..	..	..	..	..	..	·01	·01	..	·02	·02	·01	·02
7	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
9	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
11	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·02	..	..	..	..	..	..	..
13	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
14	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
15	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	..
16	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
17	..	..	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
18	..	..	..	..	..	..	·01	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	·01	..	·01	..
19	·01	..	..	..	·01	..	..	·01	..	·01	..	..	..	..	..	..	..	..	..	..	·01	..	..	·01	·01
20	·01	·01	..	..	..	·03	·01	..	..	..	·01	..	..	..	..	·01	..	..	·01	..	·02	·01	·01	·01	..
21	·01	..	..	..	..	..	..	..	..	·01	..	·01	..	..	..	·01	..	·01	..	..	·01	·01	..	..	·01
22	·02	..	..	..	..	·01	·01	..	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	·02	..	..
23	..	·02	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	·01	..	..	..
24	..	..	..	..	·01	..	..	..	..	·01	·01	·01	..	..	..	·01	..	..	·01	·02	..	·01	..	..	..
25	..	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	·02	·02	..
26	..	..	..	..	·02	..	..	..	..	·01	..	·01	..	..	..	..	..	·02	..	..	..	..	..	..	..
27	..	..	..	..	..	..	..	·03	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
28	..	..	..	·03	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..
Total	·05	·06	·16	·07	·07	·07	·09	·05	·04	·05	·03	·06	.02	·00	·00	·04	·00	·05	·05	·03	·07	·09	·07	·07	·05
From Jan. 1	3·06	4·06	2·94	2·76	3·11	2·50	2·80	2·40	2·42	2·16	1·94	2·23	2·13	2·05	1·94	2·10	2·10	2·15	2·16	2·21	2·59	2·47	2·67	2·42	2·10

Daily Rainfall.

Day of Month	Keston (Heathfld.)	Keston (Tow. Fds.)	Orpington	Farning-ham Hill	Wilming-ton	Chislehurst	Bickley	Beckenham	South Norwood	Wimbledon (Sew. Wks.)	Wimbledon (Mt. Ararat)	Raynes Park	New Malden	Esher	Surbiton	Kingston	Richmond	Kew	Brixton	West Norwood	Sydenham	Forest Hill	Deptford	Greenwich	Eltham
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·01	..	..	·01	..	..	..	..	..	..	..	·01	..	·01	..	..	..	·01	..	..	..	..	..	..	..
2	·01	..	..	..	·03	·01	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..
3	..	..	..	..	·02	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
4	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
5	..	..	..	..	·02	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
6	·02	·02	..	·02	·04	·03	·02	·01	..	..	..	..	..	..	..	..	..	·01	·01	..	..	·01	·01	·01	..
7	..	..	..	..	·02	..	·01	..	..	..	·01	..	..	..	..	..	·01	..	..	..	..	..	..	..	..
8	..	..	·01	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
9	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
10	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
11	..	..	..	..	·02	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
13	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
14	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
15	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	..	..
16	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	..	..
17	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	..	..
18	..	·01	..	·02	..	·01	..	..	..	..	·01	·02	..	..	..	..	..	·01	·01	·01	..	..	..	·01	..
19	·02	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
20	·01	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	·01	..	..	..
21	..	..	..	..	..	..	..	..	·02	..	·01	..	..	..	..	..	..	..	..	·01	·02	·01	..	..	..
22	·01	·01	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	..
23	·01	..	..	·01	..	..	..	..	..	..	..	·01	..	..	..	..	..	·01	·01	·01	..	·01	..	..	..
24	..	..	..	·01	..	..	..	..	..	..	·03	·02	..	..	..	..	..	·01	·01	..	..	·01	..	·01	..
25	..	·01	..	..	·01	·02	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	·03	·01	..	..	..
26	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..
27	..	..	..	..	..	..	·04	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
28	..	..	..	..	..	..	..	..	·02	..	..	..	..	..	..	..	·02	..	..	..	..	..	..	..	..
Total	·09	·05	·01	·08	·20	·08	·07	·01	·04	·00	·07	·06	·00	·01	·00	·00	·03	·09	·04	·05	·05	·07	·01	·03	·00
From Jan. 1	2·61	2·66	2·04	2·08	1·67	1·97	2·05	1·52	1·79	1·57	1·77	2·00	1·73	1·15	1·82	1·49	1·81	1·60	1·79	1·61	1·81	1·56	1·52	1·59	1·70

Daily Rainfall. March, 1891.

Day of Month	Dorking	ReigateHill	Caterham	Marden Park	Kenley	Purley (Reedham)	Purley (Tudor C.)	Banstead	Ashtead	Sutton	Carshalton	Wallington	Bedding- ton
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	·01	..	..	·01	..	..	..	..	..	..	..	..
2	..	·01	..	..	..	..	..	..	..	..	..	·01	..
3	..	..	..	..	..	..	..	..	..	..	..	..	..
4	..	..	..	..	..	..	..	..	..	..	..	..	..
5	..	..	..	..	..	..	..	..	..	..	..	..	..
6	..	..	·08	..	..	..	..	..	..	..	..	..	..
7	·58	·60	·60	·61	·43	·38	·01	·42	·50	·48	·48	·48	·49
8	·13	·15	·18	·16	·17	·20	·40	·15	·10	·15	·15	·17	·16
9	·75	·76	·60	·51	·16	·20	·61	·42	·20	·33	·54	·26	·45
10	·48	·52	·24	·20	·26	·25	·65	·37	·18	·27	·34	·35	·36
11	..	·03	..	..	..	..	·10	·02	..	..	..	·02	·01
12	..	..	..	..	..	..	..	..	..	..	..	·06	..
13	·03	..	..	..	·01	..	..	..	..	..	..	·01	·01
14	·02	..	..	·03	·02	·02	·11	·01	..	..	·01	·01	·01
15	·45	·41	·51	·39	·44	·38	·31	·44	·40	·41	·34	·46	·33
16	·04	·05	..	·08	·09	·06	·04	·03	·08	·03	·02	·04	·04
17	·07	·06	·06	·06	·08	·08	·09	·06	·06	·06	..	·08	·08
18	..	·01	..	·01	·01	..	·04	..	..	..	·06	..	..
19	..	..	..	..	..	..	·02	..	..	..	·01	..	..
20	..	·01	..	·07	·07	·02	·04	·02	..	·03	·01	..	..
21	·03	..	..	·01	·01	·01	·02	..	..	·02	·02	·02	·02
22	..	..	·07	..	..	..	..	·02	·06	·01	·01	..	..
23	·03	·03	..	..	..	·01	·01	..	..	..	..	..	..
24	·02	·02	..	·01	·04	·04	·05	·07	·10	·09	·08	·08	·10
25	·08	·07	·07	·05	·13	·11	·11	·05	·15	·11	·15	·13	·14
26	·05	·02	..	..	·02	·03	·04	..	·07	·02	·02	·02	·02
27	·07	·03	..	·02	..	·01	·02	·02	..	·01	..	·01	..
28	..	..	..	..	·02	..	..	..	..	..	·02	..	..
29	·03	..	..	..	·02	·01	·01	..	·04	..	..	·01	·02
30	..	..	..	..	..	..	..	..	..	·01	..	..	..
31	..	..	..	..	..	..	..	..	..	..	..	..	..
Total	2·86	2·79	2·41	2·21	1·99	1·81	2·68	2·10	1·94	2·03	2·26	2·22	2.24
From Jan. 1	5·92	6·85	5·35	4·97	5·10	4·31	5·48	4·50	4·36	4·19	4·20	4·45	4·37

Day of Month	Waddon	Croydon (Brim. Bn.)	Croydon (Limes Rd.)	Croydon (Whitgift)	Addiscomb. (Hvlk. Rd.)	Addiscomb. (Outm. Rd.)	Addington Hills	Addington (Park Fm.)	Addington (Pump. St.)	West Wickham	Hayes Common	Keston (Bradfield)
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·02	..	..	..	..	..	..	..	..	..	..	..
2	..	·03	..	..	..	..	..	·02	..	..	·01	..
3	..	..	..	..	..	..	..	..	..	..	..	..
4	..	..	..	..	..	..	..	..	..	..	..	..
5	..	..	..	..	..	..	..	..	..	..	..	..
6	..	..	..	..	..	..	..	..	..	..	..	..
7	·48	·49	·58	·45	·48	·48	·40	·35	·37	·55	·47	·36
8	·18	·19	·09	·34	·18	·18	·18	·27	·20	·19	·16	·17
9	·19	·08	·26	·95	·38	·44	·05	·43	·13	·40	·20	·31
10	·19	·29	·30	·61	·37	·39	·25	·35	·20	·34	·49	·42
11	·02	..	·01	·03	·01	·01	·03	·02	·01	·01	·03	·04
12	..	..	..	..	..	..	..	·34	..	..	..	..
13	..	·03	·01	·01	·01	·01	·01	·01	·01	..	·02	·01
14	·01	·02	·01	·01	·01	·01	·01	·01	·01	..	·03	·01
15	·31	·30	·33	·33	·34	·34	·33	·37	·35	·43	·35	·33
16	·04	·04	·02	·04	·05	·03	·08	·07	·04	·04	·04	·04
17	·08	·06	·06	·07	·08	·08	·08	·06	·08	·09	·07	·08
18	..	..	..	..	..	..	..	·07	..	..	..	·01
19	..	..	..	..	..	..	..	..	..	..	..	..
20	·02	·02	·02	·03	·03	·03	·05	..	·07	·05	·02	·04
21	..	..	..	·03	·02	·02	·02	·01	·01	·01	·01	..
22	·01	..	..	..	..	..	..	..	..	..	..	..
23	..	..	..	·01	..	..	..	..	..	..	..	..
24	·07	·14	·09	·09	·09	·08	·05	·09	·05	..	·04	·04
25	·13	·11	·12	·12	·13	·12	·15	·08	·14	·13	·12	·11
26	·02	·02	·01	·02	·03	·02	·03	·04	·04	·03	·04	·02
27	·01	..	·01	·01	·02	·01	·01	·02	·01	·01	·01	·01
28	..	..	..	..	..	..	..	..	..	..	..	..
29	·02	..	·01	·02	·02	·02	..	·02	·01	·01	·01	·01
30	..	..	..	..	..	..	·01	·01	..	..	..	..
31	..	..	..	..	..	..	..	..	..	..	..	..
Total	1·80	1·82	1·93	3·17	2·25	2·27	1·74	2·64	1·73	2·29	2·12	2·01
From Jan. 1	3·85	3·76	4·03	5·27	4·40	4·43	3·95	5·23	4·20	4·96	4·54	4·11

Daily Rainfall. March, 1891.

Day of Month	Keston (Heathfld.)	Keston (Tow. Fds.)	Orpington	Farningham Hill	Wilmington	Chislehurst	Bickley	Beckenham	South Norwood	Wimbledon (Sew. Wks.)	Wimbledon (Mt. Ararat)	Raynes Park	New Malden	Esher	Surbiton	Kingston	Richmond	Kew	Brixton	West Norwood	Sydenham	Forest Hill	Deptford	Greenwich	Eltham
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	..	..	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	..
2	..	..	..	..	..	..	..	..	..	·02	..	·03	..	·01	..	..	..	..	..	·01	..	..	..	..	·01
3	..	..	..	..	..	..	..	..	..	..	·02	..	..	..	..	..	..	..	..	..	..	..	..	..	..
4	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
7	·46	·43	·46	·52	·41	·46	·47	·43	·48	·57	·56	·55	·49	·37	·53	·56	·46	·46	·47	·61	·64	·62	·50	·52	·60
8	·18	·19	·13	·17	·12	·12	·14	·12	·17	·07	·02	·09	·08	·02	·06	·05	·06	·04	·10	·12	·13	·13	·05	·06	·11
9	·22	·44	·48	·42	·31	·22	·72	·36	·20	·47	·16	·30	·08	·21	·48	..	·24	·10	·36	·60	·31	·31	·30	·37	·45
10	·33	·57	·45	·73	·22	·26	·65	·23	·34	·30	·24	·40	·12	·07	·45	·16	·23	·17	·40	·35	·37	·37	·28	·37	·38
11	·04	·04	·03	·01	·02	·04	·03	·02	..	·01	·06	·01	..	·02	·02	·01	·01	·01	..	·02	·02	..	·02	·03	·03
12	..	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
13	·02	..	..	..	·02	·01	..	·01	·03	·02	..	·03	·05	..	..	..	·07	·04	·01	·02	..	·02	..	·01	·02
14	·02	·04	..	·01	..	·01	·03	·01	·01	..	..	·02	..	..	·02	·05	·01	·01	..	·01	..	·02	·01	·01	·01
15	·39	·37	·35	·26	·25	·27	·30	·25	·29	·25	·24	·28	·20	·12	·25	·26	·19	·19	·25	·27	·30	·29	·19	·21	·26
16	·03	·03	·03	·04	·07	·05	·06	·06	·04	·03	..	·03	·02	·02	·03	·03	·01	·03	·01	·07	·06	·02	·07	·09	·03
17	·09	·09	·01	·10	·07	·09	·10	·06	·07	·06	·08	·06	·05	·06	·07	·03	·08	·05	·09	·07	·07	·09	·09	·10	·11
18	..	..	..	·01	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..
19	..	..	..	·02	·02	..	..	..	..	..	·03	..	..	..	..	..	..	..	..	..	..	·01	..	..	·01
20	·04	·03	..	..	..	·01	·03	·02	·04	·01	..	·02	..	..	..	·01	·01	·02	..	..	..	·05	·01	·04	·03
21	·01	..	..	..	..	·01	..	..	·01	·03	..	·03	·02	..	·03	..	·01	·01	..	·02	·05	·02	..	·01	·01
22	..	..	..	..	..	..	·01	..	·01	·02	..	·03	·03	·01	·02	·05	·04	·04	..	..	..	..	..	..	..
23	..	..	..	..	..	..	..	..	..	..	·02	..	..	·01	..	·01	·01	..	..	..	..	..	..	..	..
24	·05	·05	·03	·04	·05	·05	·09	·05	·07	·03	·03	·08	·05	·05	·06	·02	·03	·03	·03	·04	·06	·04	·01	·01	·04
25	·15	·18	·06	·08	·15	·15	·16	·19	·13	·16	·18	·24	·16	·25	·27	·12	·12	·08	·18	·27	·35	·30	·20	·21	·27
26	·03	·04	..	·02	·02	·03	·02	·02	·04	·05	·02	·03	..	·03	·02	..	·02	·02	·02	·02	·02	·02	·03	·04	·04
27	·02	·01	·05	·02	·05	·04	·03	·01	..	..	..	·01	..	·01	..	·01	·01	·01	·02	..	·01	·02	·03	·06	·06
28	..	..	..	·03	..	..	..	..	·01	..	..	·01	..	..	..	·01	..	·01	..	..	..	..	..	..	..
29	·01	..	..	..	..	·01	..	..	..	..	·02	·02	..	..	..	..	·01	..	..	..	..	..	..	..	..
30	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
31	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Total	2·09	2·51	2·08	2·48	1·78	1·84	2·83	1·85	1·94	2·10	1·68	2·27	1·35	1·27	2·31	1·38	1·62	1·32	1·95	2·50	2·39	2·33	1·79	2·14	2·47
From Jan. 1	4·69	5·17	4·12	4·56	3·45	3·81	4·88	3·37	3·73	3·67	3·45	4·27	3·08	2·42	4·13	2·87	3·43	3·01	3·74	4·11	4·20	3·89	3·31	3·73	4·17

Daily Rainfall. April, 1891.

Day of Month	Dorking	ReigateHill	Caterham	Marden Park	Kenley	Purley (Reedham)	Purley (Tudor C.)	Banstead	Ashtead	Sutton	Carshalton	Wallington	Bedding-ton	Waddon	Croydon (Brim. Bn.)	Croydon (Limes Rd.)	Croydon (Whitgift)	Addiscmb. (Hvlk. Rd.)	Addiscmb. (Outm. Rd.)	Addington Hills	Addington (Park Fm.)	Addington (Pump. St.)	West Wickham	Hayes Common	Keston (Bradfield)
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
2	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	·01
3	·10	·05	·07	·04	·03	·04	·03	·08	·08	·11	·09	·08	·07	·06	·09	·06	·04	·05	·04	·04	..	·05	·05	·04	·05
4	·30	·43	·42	·46	·39	·36	·37	·30	·33	·27	·31	·34	·36	·34	·31	·33	·34	·31	·30	·30	·35	·34	·26	·28	·27
5	·07	·06	·03	·05	·02	·04	·06	·02	·05	·02	..	·02	·01	·02	·02	·01	·01	·03	·02	·02	·01	·02	·05	·02	·02
6	..	·05	·11	·04	·02	..	..	·01	..	..	..	·01	..	..	..	..	..	..	..	..	..	·01	·03	..	·02
7	·10	·04	·03	·04	·01	·01	·02	·02	·09	·01	..	·01	..	·01	·02	..	·01	·02	·02	·03	·03	·03	·05	·04	·06
8	·04	..	·11	·08	·11	·11	·11	·09	·07	·05	·05	·08	·08	·09	·10	·10	·09	·10	·11	·10	·03	·10	·06	·11	·10
9	·04	·11	..	·02	·03	·04	·05	·03	·04	·03	·02	·04	·03	·04	·05	·03	·04	·05	·04	·05	·06	·03	·05	·04	·04
10	..	..	·06	..	·01	..	·01	..	..	..	..	..	..	·01	..	..	..	..	..	..	·01	..	..	..	..
11	..	·01	..	·03	·01	·03	·03	·01	·03	·03	·03	·03	·03	·02	·03	·03	·04	·02	·02	·05	·02	·02	·04	·03	·02
12	·17	..	..	·01	·04	·01	·02	·12	·27	·22	·05	·06	·04	·03	·04	·02	·02	·04	·02	·03	·02	·02	·03	·03	·04
13	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·02
14	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
15	..	..	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	·01
16	·03	·01	·05	·02	·02	·02	·03	..	..	·01	·01	·01	·01	·01	..	·01	·02	·03	·02	·02	·02	·02	..	·03	·03
17	..	..	..	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
18	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
19	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
21	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
22	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
23	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
24	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	..	..	..	..
25	..	..	..	..	·01	·02	..	..	..	..	..	..	..	·01	..	·01	·01	·01	·02	·01	·01	..	..	·01	..
26	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
27	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
28	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..
29	..	·02	·03	·02	·01	..	·01	..	..	·01	..	..	..	..	..	..	..	..	·01	·01	..	..	..	..	..
30	·05	·05	·03	·02	·03	·02	·02	·03	·03	..	..	·01	..	·01	..	..	..	..	·01	·01	..	·01	..	..	..
Total	·90	·84	·94	·83	·74	·70	·77	·72	·99	·76	·56	·69	.63	·65	·66	·61	·62	·66	·64	·67	·61	·65	·62	·65	·69
From Jan.1	6·82	7·69	6·29	5·80	5·84	5·01	6·25	5·22	5·35	4·95	4·76	5·14	5·00	4·50	4·42	4·64	5·89	5·06	5·07	4·62	5·84	4·85	5·58	5·19	4·80

Daily Rainfall. **April, 1891.**

Day of Month	Keston (Heathfd.)	Keston (Tow. Fds.)	Orpington	Farning-ham Hill	Wilming-ton	Chislehurst	Bickley	Beckenham	South Norwood	Wimbledon (Sew. Wks.)	Wimbledon (Mt. Ararat)	Raynes Park
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	..	..	..	..	..	..	..	..	..	..	..
2	·01	·01	..	..	..	·01	..	·01	..	..	..	..
3	·06	..	..	..	·03	·04	·02	·02	·06	·06	·07	·06
4	·22	·35	·26	·22	·21	·32	·33	·27	·31	·38	·39	·37
5	·04	·03	·02	·01	·01	·02	·03	·02	·02	·04	·03	·05
6	·02	·01	·05	·08	..	..	..	..	..	..	..	..
7	·05	·06	·06	·10	·04	·02	·05	·01	·02	..	..	..
8	·09	..	·09	·10	·10	·12	·13	·09	·11	·06	·09	·06
9	·04	·13	·03	·04	·02	·03	·05	·06	·03	·05	..	·07
10	..	..	..	..	..	..	..	..	..	..	·03	..
11	·02	·02	·03	·01	·01	·03	·06	·01	·03	·03	..	·02
12	·04	·03	·01	·05	·03	·03	·03	·02	·02	·24	·17	·17
13	..	..	..	..	..	..	..	..	..	..	..	..
14	..	..	..	..	..	..	..	..	..	..	..	..
15	·01	..	..	..	..	·01	·01	..	..	..	..	..
16	·03	·03	·02	·07	·11	·04	·03	·02	·02	·02	·02	·02
17	..	..	..	..	..	..	..	..	..	..	..	..
18	..	..	..	..	..	..	..	..	..	..	..	..
19	·01	..	..	..	..	..	..	..	..	..	..	..
20	..	..	..	..	..	..	..	..	..	..	..	..
21	..	..	..	..	..	..	..	..	..	..	..	..
22	..	..	..	..	..	..	..	..	..	..	..	..
23	..	..	..	..	..	..	..	..	..	..	..	..
24	..	..	..	·02	..	..	·01	..	..	..	..	..
25	..	..	..	..	..	·01	..	·01	·01	..	..	..
26	..	..	..	..	..	..	..	..	..	..	..	..
27	..	..	..	..	..	..	..	..	..	..	..	..
28	..	..	..	..	..	..	..	..	..	..	..	..
29	·01	..	..	..	·01	..	·01	..	..	..	..	·01
30	·02	·01	..	..	..	·01	..	..	..	..	..	..
Total	·67	·68	·57	·70	·57	·69	·76	·54	·63	·88	·80	·83
From Jan.1	5·36	5·85	4·69	5·26	4·02	4·50	5·64	3·91	4·36	4·55	4·25	5·10

Day of Month	New Malden	Esher	Surbiton	Kingston	Richmond	Kew	Brixton	West Norwood	Sydenham	Forest Hill	Deptford	Greenwich	Eltham
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	..	..	..	..	..	..	..	..	..	..	..	..
2	..	·01	..	..	..	..	..	..	..	..	..	..	·01
3	·06	·10	·10	·10	·08	·09	·03	·09	·07	·07	·05	·06	·01
4	·34	·30	·35	·40	·46	·44	·41	·38	·33	·32	·27	·30	·33
5	·02	·02	·02	·06	·07	·12	·04	·06	·03	..	..	·02	·05
6	..	..	..	..	..	..	..	..	..	..	..	..	..
7	..	·04	·02	·02	..	·01	..	..	·01	·02	..	·01	·02
8	·06	·03	·10	·13	·07	·09	·04	·08	·10	·11	·03	·09	·13
9	·05	·02	·04	·04	·06	·03	·06	·05	·05	·05	..	·05	·09
10	..	·01	..	·04	..	..	..	..	..	..	..	..	..
11	..	·02	·02	..	·04	·01	·05	·01	·01	..	·01	·02	·02
12	·27	·16	·31	·32	·20	·19	·10	·06	·03	·06	·09	·11	·03
13	..	..	..	..	..	..	..	..	..	·01	..	..	..
14	..	..	..	..	..	..	..	..	..	..	..	..	..
15	..	..	..	..	..	..	..	..	..	..	..	·01	..
16	..	·01	..	..	·02	·02	·01	·02	·02	..	·04	·04	..
17	..	..	..	..	..	..	..	..	..	..	..	..	..
18	..	..	..	..	..	..	..	..	..	..	..	..	..
19	..	..	..	..	..	..	..	..	..	..	..	..	·01
20	..	..	..	..	..	..	..	..	..	..	..	..	..
21	..	..	..	..	..	..	..	..	..	..	..	..	..
22	..	..	..	..	..	..	..	..	..	..	..	..	..
23	..	..	..	..	..	..	..	..	..	..	..	..	..
24	..	..	..	..	..	..	..	..	..	..	..	..	·02
25	..	..	..	..	..	..	..	..	·02	..	..	·01	..
26	..	..	..	..	..	..	..	..	..	..	..	..	..
27	..	..	..	..	..	..	..	..	..	..	..	..	..
28	..	..	..	..	..	..	..	..	..	..	..	..	..
29	..	..	·02	..	..	..	..	..	..	..	..	..	·01
30	..	..	..	..	..	..	..	..	..	..	..	..	..
Total	·80	·72	·98	1·11	1·00	1·00	·74	·75	·67	·64	·54	·72	·78
From Jan.1	3·88	3·14	5·11	3·98	4·43	4·01	4·48	4·86	4·87	4·53	3·85	4·45	4·95

Daily Rainfall. May, 1891.

Day of Month	Dorking	ReigateHill	Caterham	Marden Park	Kenley	Purley (Reedham)	Purley (Tudor C.)	Banstead	Ashtead	Sutton	Carshalton	Wallington	Bedding-ton	Waddon	Croydon (Brim. Bn.)	Croydon (Limes Rd.)	Croydon (Whitgift)	Addiscmb. (Hvlk. Rd.)	Addiscmb. (Outm. Rd.)	Addington Hills	Addington (Park Fm.)	Addington (Pump. St.)	West Wickham	Hayes Common	Keston (Bradfield)
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·35	·26	·34	·24	·27	·23	·23	·25	·25	·19	·15	·18	·16	·17	·14	·18	·17	·21	·20	·22	·21	·24	·23	·20	·18
2	·08	·04	·15	·25	·09	·11	·07	·08	·14	·08	·06	·08	·09	·07	·09	·06	·07	·04	·04	·05	·09	·04	·10	·06	·06
3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
4	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
7	·03	·05	..	·01	·01	·02	·02	..	·03	..	..	·01	·01	·02	..	·01	·02	·01	·01	·02	..	·01	..	..	..
8	·02	·04	·12	·10	·10	·10	·10	·08	·04	·08	·08	·08	·07	·08	..	·08	·09	·07	·08	·08	·05	·08	·09	·07	·06
9	..	·02	·02	·01	·02	·03	·04	·02	..	·02	·02	·03	·02	·03	·11	·03	·04	·05	·05	·04	·06	·02	·03	·04	·04
10	·02	·01	..	..	·01	·01	·02	..	..	..	..	·01	..	..	..	..	..	..	·01	..	·01	..	..	·01	·01
11	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..
12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
13	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
14	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
15	·27	·28	·23	·26	·22	·22	·22	·21	·17	·08	·20	·21	·29	·28	·22	·24	·27	·27	·28	·23	·32	·35	·35	·31	·33
16	·15	·10	·10	·05	·05	·06	·05	·09	·15	·04	·02	·05	·04	·04	·04	·03	·03	·06	·05	·04	·05	·03	·04	·05	·04
17	·35	·47	·48	·47	·47	·48	·47	·44	·40	·32	·38	·39	·41	·42	·39	·45	·45	·42	·42	·42	·31	·44	·35	·41	·42
18	·13	·07	·11	·10	·15	·17	·17	..	·12	·14	·10	·18	·16	·15	·15	·11	·11	·17	·15	·16	·26	·15	·22	·17	·16
19	·06	·06	·05	·04	·04	·03	·04	·02	..	·06	·14	·04	·04	·04	·03	·03	·03	·03	·02	·02	·03	·03	·03	·02	·02
20	·30	·32	·36	·39	·27	·28	·25	·28	·22	·37	·38	·28	·27	·27	·26	·28	·26	·27	·28	·33	·25	·31	·42	·35	·36
21	·09	·11	·16	·20	·10	·10	·13	·11	·14	·09	·09	·08	·08	·09	·09	·08	·10	·08	·07	·11	·09	·09	·12	·10	·15
22	..	·01	·01	·01	·12	·05	·05	·06	..	·02	·02	·01	..	·01	..	·01	·01	·02	·01	·02	·03	·09	·16	·02	·04
23	·10	·10	·08	·09	·08	·06	·06	·06	·03	·07	·05	·04	·04	·05	·05	·06	·05	·04	·04	·03	·12	·03	·03	·03	·05
24	·49	·39	·53	·52	·30	·36	·32	·82	·91	·93	·99	·70	·66	·46	·49	·48	·40	·56	·54	·33	·30	·29	·53	·33	·52
25	·04	·04	·10	·03	·04	·05	·05	·03	·02	·03	·03	·04	·04	·04	·04	·04	·04	·06	·04	·06	·01	·05	·06	·04	·05
26	·15	·20	·07	·10	·07	·06	·03	·02	·04	·13	·08	·08	·06	·04	·05	·03	·02	·02	·02	·02	·08	·04	·05	·03	·02
27	·27	·08	·13	·13	·17	·19	·22	·54	·35	·41	·49	·55	·45	·47	·41	·47	·45	·34	·30	·22	·21	·22	·16	·16	·11
28	..	·02	..	·01	·01	..	·01	..	·02	..	..	..	..	·01	..	..	·01	..	..	..	·02	..	·01	·01	·01
29	·10	·13	·18	·20	·14	·12	·12	·11	·08	·11	·11	·11	·11	·12	·12	·17	·13	·15	·14	·16	·09	·17	·20	·18	·24
30	..	·04	·05	·08	·06	·08	·07	..	..	·02	..	·04	·06	·07	·06	·01	·06	·06	·04	·06	·12	·12	·17	·13	·17
31	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·04
Total	2·98	2·84	3·27	3·29	2·80	2·81	2·74	3·22	3·11	3·19	3·39	3·19	3·06	2·93	2·74	2·85	2·81	2·93	2.79	2·62	2·71	2·80	3·35	2·73	3·08
From Jan.1	9·80	10·53	9·56	9·09	8·64	7·82	8·99	8·44	8.46	8·14	8·15	8·33	8·06	7·43	7·16	7·49	8·70	7·99	7·86	7·24	8·55	7·65	8·93	7·92	7·88

Day of Month	Keston (Heathfld.)	Keston (Tow. Fds.)	Orpington	Farning-ham Hill	Wilming-ton	Chislehurst	Bickley	Beckenham	South Norwood	Wimbledon (Sew. Wks.)	Wimbledon (Mt. Ararat)	Raynes Park	New Malden	Esher	Surbiton	Kingston	Richmond	Kew	Brixton	West Norwood	Sydenham	Forest Hill	Deptford	Greenwich	Eltham
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·21	·18	·06	·10	·08	·19	·16	·15	·18	·18	·19	·20	·14	·16	·22	·22	·12	·12	·17	·12	·12	·06	·09	·10	·14
2	·09	·10	·18	·15	·12	·07	·05	·04	·11	·15	·21	·21	·18	·26	·21	·25	·24	·22	·10	·04	·13	·19	·06	·09	·05
3	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..
4	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
7	..	..	..	..	..	..	..	..	·01	·02	·03	·03	·03	·03	·02	·03	·05	·07	·02	·01	·03	·04	·02	·02	..
8	·07	·08	·04	·04	..	·04	·05	·03	·07	·06	·09	·10	·07	·04	·09	·05	·08	·06	..	·04	·04	·04	..	..	..
9	·04	·04	·01	·04	·03	·03	·06	·04	·04	·01	·02	·02	..	..	..	..	..	..	·03	·03	·05	·05	·01	·03	·07
10	·01	..	..	..	..	·01	..	..	..	..	..	·01	..	..	·01	..	..	..	..	·01	·01	..	..	..	·01
11	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
13	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
14	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
15	·42	·40	·12	·25	·13	·25	·22	·19	·30	·28	·18	·20	·16	·15	·23	·21	·17	·19	·25	·37	·30	·27	·28	·25	·21
16	·05	·04	·08	·30	·30	·08	·03	·03	·05	·04	·03	·04	·07	·10	·07	·16	·09	·06	·02	·03	·07	·04	·05	·06	·09
17	·39	·38	·33	·32	·41	·42	·44	·36	·35	·48	·47	·45	·44	·35	·48	·26	·52	·58	·51	·44	·51	·52	·50	·54	·63
18	·16	·17	·11	·13	·14	·13	·15	·13	·15	·10	·10	·10	..	·08	·08	·14	·10	·08	·13	·11	·13	·13	·11	·11	·16
19	·04	·02	·03	·03	..	·02	..	·01	·03	..	..	..	·07	·01	..	·03	·02	·06	..	·01	·02	·01	·01	·01	·04
20	·39	·37	·41	·35	·43	·33	·42	·28	·27	·24	·27	·24	·24	·24	·24	·25	·30	·31	·26	·39	·33	·36	·32	·38	·35
21	·12	·15	·12	·33	·07	·08	·10	·07	·09	·09	·10	·10	·09	·10	·09	..	·07	·08	·06	·07	·09	·09	·04	·04	·13
22	·06	·06	·08	·03	·01	·03	·05	·02	·02	·09	·12	·09	·08	·05	·08	·12	·06	·05	·22	·05	·04	·07	·08	·08	·10
23	·05	..	·04	·05	·06	·01	·02	·02	·06	·05	·06	·05	·06	·04	·08	·20	·07	·06	·02	·04	·04	·22	·06	·08	·05
24	·44	·51	·35	·34	·85	·54	·40	·30	·44	·99	·62	·68	·40	·49	·25	·13	·20	·21	·56	·74	·87	·97	·49	·41	·36
25	·05	·06	·05	·07	·06	·09	·07	·04	·06	·03	·02	·03	·01	·01	·01	·02	·02	·02	·03	·04	·04	·05	·04	·03	·06
26	·04	·02	·01	·02	..	·02	·01	·02	·07	..	..	·02	..	·01	..	·01	·07	·01	..	·05	·10	·09	·01	·01	·04
27	·15	·15	·01	·03	·04	·09	·15	·21	·38	·10	·12	·15	·12	·15	·15	·11	·09	·13	·05	·20	·27	·26	·20	·18	·13
28	·03	·02	..	·01	·04	·02	..	..	..	·01	·01	·02	·03	·06	·08	·10	·06	·05	..	..	·06	..	..	..	·01
29	·25	·25	·22	·38	·41	·24	·30	·18	·15	·13	·09	·09	·10	·10	·09	·12	·14	·15	·15	·13	·14	·20	·19	·22	·28
30	·18	·22	·02	·01	·01	·27	·10	·06	·04	..	..	·01	..	..	..	..	·02	·01	·01	·02	·04	..	·03	·05	·08
31	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Total	3·24	3·22	2·27	2·98	3·19	2·96	2·78	2·18	2·87	3·05	2·73	2·84	2·29	2·44	2·48	2·41	2·49	2·52	2·59	2·94	3·43	3·66	2·59	2·69	2·99
From Jan. 1	8·60	9·07	6·96	8·24	7·21	7·46	8·42	6·09	7·23	7·60	6·98	7·94	6·17	5·58	7·59	6·39	6·92	6·53	7·07	7·80	8·30	8·19	6·44	7·14	7·94

Daily Rainfall. **June, 1891.**

Day of Month	Dorking	ReigateHill	Caterham	Marden Park	Kenley	Purley (Reedham)	Purley (Tudor C.)	Banstead	Ashtead	Sutton	Carshalton	Wallington	Bedding-ton	Waddon	Croydon (Brim. Bn.)	Croydon (Limes Rd.)	Croydon (Whitgift)	Addiscmb. (Hvlk. Rd.)	Addiscmb. (Outm.Rd.)	Addington Hills	Addington (Park Fm.)	Addington (Pump. St.)	West Wickham	Hayes Common	Keston (Bradfield)
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·15	·17	·21	·27	·18	·16	·18	·15	·16	·20	·16	·17	·10	·10	·10	·09	·09	·09	·08	·10	..	·10	·09	·10	·11
2	..	·01	·01	·01	·01	·02	·02	..	..	..	·01	·01	·01	·02	..	·02	·02	·02	·02	·02	·01	·01	·02	·05	..
3	·15	·09	·07	·08	·09	·08	·07	·09	·11	·10	·10	·10	·08	·08	·10	·07	·07	·09	·05	·08	·04	·08	·07	·08	·07
4	·02	·06	..	·02	·01	..	·01	·03	..	·02	·02	·01	·01	·01	·01	..	..	·01	·04	·01	·06	·01	..	·01	..
5	..	·02	·03	·03	..	..	..	·03	·08	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·03	..	..	..	..
7	..	..	..	·01	·02	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
8	·04	·05	·07	·04	..	·02	·02	..	..	..	..	·01	..	..	..	..	·01	..	·01	..	·02	·01	·02	·01	·02
9	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
11	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
13	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
14	..	..	..	..	..	..	..	..	·10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
15	·25	·05	·10	·09	..	·10	·08	·07	..	·08	·07	·07	·06	·04	·08	·06	·05	·04	·05	·05	·05	·05	·05	·05	·05
16	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
17	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
18	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
19	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
21	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
22	·47	·65	·89	·85	·57	·65	·64	·52	·46	·46	·46	·52	·51	·50	·50	·55	·51	·52	·53	·59	·60	·62	·77	·62	·68
23	·06	·01	·03	·05	·04	·04	·05	·04	..	·02	·02	·03	·02	·03	·03	·02	·03	·04	·03	·04	·05	·03	·05	·05	·07
24	·25	·31	·40	·19	·17	·19	·17	·66	·37	·34	·19	·19	·13	·14	·18	·16	·15	·21	·20	·14	·25	·12	·25	·12	·15
25	..	·04	..	..	·01	·01	·03	·01	..	..	..	·01	..	·01	..	·01	·01	..	..	..	..	..	..	..	..
26	..	..	..	..	..	..	·01	..	..	·03	..	..	..	..	·01	..	·01	..	..	..	..	..	..	..	..
27	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	..	..
28	·04	·05	..	·07	·04	·04	·04	·03	..	·04	·03	·03	·03	·03	..	·03	·04	·03	·03	·03	·03	·03	..	·04	·07
29	·03	·03	..	·08	·03	·03	·02	·02	·10	·03	..	·01	·01	·01	·04	·01	·02	·01	·02	·02	·01	·03	·13	·04	·02
30	·15	·30	·42	·13	·30	·26	·21	·18	·18	·18	·35	·23	·21	·44	·12	·45	·21	·32	·29	·22	..	·20	·15	·23	·39
Total	1·61	1·84	2.23	1·92	1·47	1·60	1·56	1·83	1.56	1·50	1·41	1·39	1·17	1·41	1·17	1·47	1·22	1·39	1.35	1·30	1·15	1·29	1·60	1·40	1·63
From Jan.1	11·41	12.37	11·79	11·01	10·11	9·42	10·55	10·27	10.02	9·64	9·56	9·72	9·23	8·84	8·33	8·96	9·92	9 ·38	9·21	8·54	9·70	8·94	10·53	9·32	9·51

Day of Month	Keston (Heathfd.)	Keston (Tow. Fds.)	Orpington	Farningham Hill	Wilmington	Chislehurst	Bickley	Beckenham	South Norwood	Wimbledon (Sew. Wks.)	Wimbledon (Mt. Ararat)	Raynes Park	New Malden	Esher	Surbiton	Kingston	Richmond	Kew	Brixton	West Norwood	Sydenham	Forest Hill	Deptford	Greenwich	Eltham
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·11	·12	·09	·01	..	·05	·09	·07	·06	·30	·15	·13		·12	·14	·13	·15	·15	·08	·06	·08	·11	·12	·09	·04
2	·05	·07	·06	·05	·11	·06	·06	·05	·04	·02	·01	·02		·01	..	·01	·02	·01	·06	·05	·07	·04	·05	·05	·07
3	·07	..	·05	·04	·05	·05	·05	·06	..	·13	·10	·10		·06	·09	·15	·16	·28	·07	·10	·10	·10	·08	·08	·07
4	..	·07	..	·02	·01	·02	·02	·01	·01	..	·04	·04		·02	..	·02	·04	·06	·03	..	·02	·02	·01	·02	·02
5	..	..	..	..	..	..	..	..	..	..	..	..		..	..	..	..	..	..	..	..	..	..	..	..
6	..	..	..	..	..	..	..	..	..	..	..	..		..	..	..	..	..	..	..	..	..	..	..	..
7	..	..	..	..	..	..	..	..	..	..	..	..		..	..	..	..	..	..	..	..	..	..	..	..
8	·03	..	·01	·02	..	..	..	..	..	..	..	·01		..	..	..	..	..	..	·01	..	..	..	..	·01
9	..	..	..	..	..	..	..	..	..	..	..	..		..	..	..	..	..	..	..	..	..	..	..	..
10	..	..	..	..	..	..	·10	..	..	..	..	..		..	..	..	..	..	..	..	..	..	..	..	..
11	..	..	..	..	..	..	..	..	..	..	..	..		..	..	..	..	..	..	..	..	..	..	..	..
12	..	..	..	..	..	..	..	..	..	..	..	..		..	..	..	..	..	..	..	..	..	..	..	..
13	..	..	..	..	..	..	..	..	..	..	..	..		..	..	..	..	..	..	..	..	..	..	..	..
14	..	..	..	..	..	..	..	..	..	..	..	..		..	..	..	..	..	..	..	..	..	..	..	..
15	·06	·06	·03	·04	·04	·08	..	·06	·04	·06	·07	·06	RECORD CEASED.	·07	·09	·09	·08	·07	·23	·07	·08	..	·03	·05	·07
16	..	..	..	..	..	..	..	..	..	..	..	..		..	..	..	..	..	..	..	..	..	..	..	..
17	..	..	..	..	..	..	..	..	..	..	..	..		..	..	..	..	..	..	..	..	..	..	..	..
18	..	..	..	..	..	..	..	..	..	..	..	..		..	..	..	..	..	..	..	..	..	..	..	..
19	..	..	..	..	..	..	..	..	..	..	..	..		..	..	..	..	..	..	..	..	..	..	..	..
20	..	..	..	..	..	..	..	..	..	..	..	..		..	..	..	..	..	..	..	..	..	..	..	..
21	..	..	..	..	..	..	..	..	..	..	..	..		..	..	..	..	..	..	..	..	..	..	..	..
22	·71	·70	·68	·76	·48	·48	·55	·43	·48	·62	·64	·56		·40	·52	·59	·63	·60	·56	·62	·60	·55	·56	·55	·43
23	·07	·06	·05	·09	·05	·06	·05	·03	·03	·02	·02	·03		·02	..	·01	·01	·01	·03	·04	·06	·05	·02	·03	·08
24	·14	·09	·05	·02	·02	·04	·07	·07	·16	·24	·35	·33		·42	·50	·30	·34	·38	·14	·14	·09	..	·02	·04	·04
25	..	..	..	..	..	..	·02	..	..	..	..	..		·01	..	..	·01	·01	..	..	..	..	..	..	·01
26	..	..	..	..	..	..	..	..	..	..	..	·01		·01	..	..	..	..	..	..	..	..	..	..	..
27	..	..	..	..	..	..	..	..	..	..	..	..		..	..	..	..	..	..	..	..	..	..	..	..
28	·04	..	·06	..	·09	·04	..	·01	..	·02	..	·03		..	..	·01	·01	·01	..	·02	..	..	..	·02	·04
29	·06	·10	·05	·09	·01	·04	..	·01	·04	..	·03	·03		·01	·05	·03	·01	·01	·03	·02	·03	·02	·02	·02	·01
30	·30	·12	·25	·38	·52	·24	·48	·14	·22	·15	..	·12		·12	·16	·18	·13	·16	·06	·18	·18	·05	·18	·17	·25
Total	1·64	1·39	1·38	1·52	1·38	1·16	1·49	·94	1·08	1·56	1·41	1·47		1·27	1·55	1·52	1·59	1·75	1·29	1·31	1·31	·94	1·14	1·12	1·14
From Jan. 1	10·24	10·46	8·34	9·76	8·59	8·62	9·91	7·03	8·31	9·16	8·39	9·41		6·85	9·14	7·91	8·51	8·28	8·36	9·11	9·61	9·13	7·58	8·26	9·08

Day of Month	Dorking	ReigateHill	Caterham	Marden Park	Kenley	Purley (Reedham)	Purley (Tudor C.)	Banstead	Ashtead	Sutton	Carshalton	Wallington	Bedding-ton	Waddon	Croydon (Brim. Bn.)	Croydon (Limes Rd.)	Croydon (Whitgift)	Addiscomb. (Hvlk. Rd.)	Addiscomb. (Outm.Rd.)	Addington Hills	Addington (Park Fm.	Addington (Pump. St.)	West Wickham	Hayes Common	Keston (Bradfield)
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·25	·32	·29	·57	·30	·46	·42	·31	·25	·31	·16	·31	·34	·13	·35	·13	·41	·28	·31	·40	·04	·42	·58	·45	·30
2	·02	·02	..	·01	·05	·03	·03	..	..	..	·02	..	..	·02	..	..	..	·01	·01	·01	·25	·02	·02	·02	·02
3	·10	·02	..	·11	·23	·18	·17	·07	·05	·03	·01	·04	·03	·04	·03	·03	·03	·03	·03	·08	..	·22	·12	·12	·11
4	·32	·79	·48	·22	·07	·06	·07	·06	·06	·02	..	·01	·02	·03	..	·01	·01	..	·01	·04	·03	·03	·04	·01	·04
5	·10	·10	..	·06	·07	·07	·06	·08	·09	·08	·06	·07	06	·05	·06	·07	·07	·07	·06	·04	·02	·04	·03	·02	·03
6	·03	·03	·13	·05	·03	·02	·05	..	·14	·15	·10	·27	·24	·24	·22	·26	·30	·19	·20	·04	·07	·01	·04	·08	·01
7	·63	·57	·50	·58	·94	1·04	·86	·76	·42	·51	·59	·64	·58	·53	·45	·50	·46	·43	·44	·99	·23	1·17	·86	·04	·78
8	·34	·42	·22	·15	·16	·17	·18	·24	·38	·26	·18	·22	·22	·19	·15	·17	·18	·30	·30	·24	·97	·26	·49	·65	·61
9	..	..	..	..	·01	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	..	·32	..	..	..	..
10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
11	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
13	..	·16	..	·05	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..
14	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·04	..	..	..	..
15	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
16	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
17	..	..	·08	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..
18	·04	·04	..	·01	·04	..	..	·08	·02	·05	·03	·04	·04	·02	..	·01	·02	·02	·02	..	..	·01	·02	·02	·03
19	·05	·06	·09	·09	·20	·19	·21	·28	·18	·36	·41	·35	·42	·31	·42	·34	·34	·29	·27	·70	·39	·22	·15	·50	·19
20	·06	·10	·10	·08	·08	·06	·07	·05	·07	·03	·02	·03	·02	·03	·03	·02	·02	·01	·01	·04	·06	·02	·03	·01	·03
21	..	..	..	..	..	..	·02	..	..	..	..	..	..	..	..	..	..	..	..	..	·24	..	..	..	..
22	·15	·09	·17	·13	·10	·15	·07	·05	·06	·07	·10	·06	·08	·09	·12	·10	·11	·14	·13	·08	·07	·25	·20	·18	·35
23	·10	·13	·07	·08	·11	·08	·09	·07	·08	·08	·05	·10	·09	·08	·10	·06	·10	·10	·10	·10	·02	·10	·10	·10	·12
24	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
25	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
26	·20	·59	·75	·77	..	·26	·26	·34	·20	·28	·45	·18	·18	·28	·18	·50	·18	·17	·09	·27	·09	·30	·15	·35	·41
27	·61	·37	..	·49	·87	·69	·78	·64	·74	·65	·58	·88	·78	·70	·76	·44	·66	·75	·82	·79	1·02	·79	1·11	·69	·72
28	·02	·02	·29	·31	·02	·01	·02	..	·04	·02	·02	·01	·02	·02	·02	·01	..	·01	·01	·01	·03	·01	·01	·01	..
29	·22	·24	·53	..	·30	·30	·33	·36	·32	·30	·41	·32	·34	·33	·36	·37	·34	·31	·30	·33	·29	·27	·29	·19	·23
30	·16	·09	·12	·04	·06	·06	·11	·03	·05	·07	·15	·23	·35	·35	·25	·26	·24	·23	·23	·28	·23	·43	·22	·35	·35
31	·02	·07	·87	·18	1·14	1·06	1·25	..	..	..	·02	·08	·56	·68	·66	·86	·52	·42	·35	·19	·09	·08	·05	·05	·03
Total	3·42	4·23	4·69	3·98	4·78	4·89	5·05	3·42	3·15	3·27	3·36	3·84	4·37	4·13	4·16	4·14	3·99	3·76	3·69	4·63	4·51	4·65	4·51	4·45	4·36
From Jan.1	14·83	16.60	16·48	14·99	14·89	14·31	15·60	13·69	13.17	12·91	12·92	13·56	13·60	12·97	12·49	13·10	13·91	13·14	12·90	13·17	14·21	13·59	15·04	13·77	13·87

Day of Month	Keston (Heathfld.)	Keston (Tow. Fds.)	Orpington	Farningham Hill	Wilmington	Chislehurst	Bickley	Beckenham	South Norwood	Wimbledon (Sew. Wks.)	Wimbledon (Mt. Ararat)	Raynes Park	New Malden
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·41	·65	·61	·52	·43	·52	·30	·38	·22	·35	·40	·33	
2	·03	·02	..	..	..	..	·01	..	..	..	·01	·02	
3	·15	·14	·11	·06	·07	·05	·03	·01	·01	·21	·21	·15	
4	·05	·02	·02	·02	..	..	..	..	..	·01	..	·01	
5	·05	·03	·01	·03	·02	·04	·04	·06	·09	·02	·03	·04	
6	·03	·02	..	·01	·10	·12	·18	·10	·14	·20	·12	·23	
7	·89	·79	·70	·57	·50	·41	·41	·26	·34	·25	·27	·28	
8	·63	·75	·34	·44	·52	·43	·42	·65	·41	·36	·17	·16	
9	..	..	..	..	..	·01	..	..	..	..	..	..	
10	..	..	..	..	..	..	..	..	..	..	..	..	
11	..	..	..	..	..	..	..	..	..	..	..	..	
12	..	..	..	..	..	..	..	..	..	..	..	..	
13	..	..	..	..	..	..	..	..	..	..	..	..	
14	..	..	..	..	..	..	..	..	..	..	..	..	
15	..	..	..	..	..	..	..	..	..	..	..	..	RECORD CEASED.
16	..	..	..	..	..	..	..	..	..	..	..	..	
17	..	..	·05	..	..	..	..	..	..	..	..	..	
18	·03	·02	·02	·04	·02	·03	..	·01	·02	·23	·10	·13	
19	·19	·26	·10	·03	·48	·47	·03	·55	·60	·42	·54	·55	
20	·04	·02	·01	..	·01	·02	·40	·01	·04	·02	·01	·04	
21	..	..	..	..	..	..	·03	..	..	·02	·01	·02	
22	·41	·36	·48	·30	·07	·25	·23	·18	·34	·09	·09	·18	
23	·10	·10	·06	·04	..	·07	·10	·08	·08	·08	·08	·08	
24	..	..	..	..	..	·01	..	..	..	..	..	..	
25	..	..	..	..	..	..	..	..	..	..	..	..	
26	·39	·16	·32	·33	·22	·25	·42	·13	·42	·13	·12	·14	
27	·73	1·03	·75	·80	·86	·85	·70	·62	·37	·62	·84	·85	
28	·01	..	..	..	·01	·02	·01	·01	·02	·02	·01	·03	
29	·27	·21	·10	·31	·19	·32	·34	·34	·29	·25	·21	·22	
30	·38	·39	·18	·10	·15	·13	·14	·10	·23	·17	·22	·22	
31	·03	·02	·11	·26	·22	·06	..	·06	·56	·01	..	·01	
Total	4·82	4·99	3·97	3·86	3·87	4·06	3·79	3·55	4·18	3·46	3·44	3·69	
From Jan. 1	15·06	15·45	12·31	13·62	12·46	12·68	13·70	10·58	..	12·62	11·83	13·10	

Day of Month	Esher	Surbiton	Kingston	Richmond	Kew	Brixton	West Norwood	Sydenham	Forest Hill	Deptford	Greenwich	Eltham
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·13	·16	·19	·17	·10	·46	·36	·44	·49	·38	·44	·41
2	·01	..	..	..	..	..	·01	..	..	·01	·01	·01
3	·04	·02	·13	·09	·10	·32	·03	·02	·03	·03	·04	·01
4	·04	·02	..	·01	·01	..	..	..	..	..	·01	..
5	·03	·03	·06	·03	·02	·03	·03	·03	..	·03	·04	·06
6	·25	·20	·28	·13	·12	·25	·28	·26	·23	·26	·25	·20
7	·53	·43	·26	·30	·31	·31	·31	·38	·42	·28	·35	·40
8	·29	·43	·27	·15	·18	·50	·63	·89	·69	·50	·50	·49
9	·01	..	..	..	..	..	..	..	..	..	..	..
10	..	..	..	..	..	..	..	..	..	..	..	..
11	..	..	..	..	..	..	..	..	..	..	..	..
12	..	..	..	..	..	..	..	..	..	..	..	..
13	..	..	..	..	..	..	..	..	..	..	..	..
14	..	..	..	..	..	..	..	..	..	..	..	..
15	..	..	..	..	..	..	..	..	..	..	..	..
16	..	..	..	·04	·07	..	..	..	..	..	..	..
17	..	..	..	..	..	..	..	..	..	..	..	..
18	·01	..	..	·08	·02	·02	·03	·01	..	..	·02	·03
19	·35	·52	·43	·68	·80	·63	·53	..	·55	·27	·31	·67
20	·02	·02	·02	·01	·01	·03	·03	·78	..	·01	·01	·01
21	..	..	..	..	·01	·07	..	·03	..	..	..	..
22	·03	·04	·12	·02	·04	·02	·08	..	·05	·04	·05	·05
23	·05	·05	·05	·03	·04	·11	·10	·17	·12	·05	·04	·06
24	..	..	..	..	..	..	..	..	..	..	..	..
25	..	..	..	..	..	..	..	..	..	..	..	..
26	·17	·18	·27	·21	·35	·11	·12	..	·03	·06	·11	·18
27	·60	·73	·63	·41	·27	·55	·65	·78	·64	·55	·61	·77
28	·01	..	·02	·02	·02	·01	·01	·01	·01	·03	·04	·02
29	·11	·30	·26	·17	·17	·21	·27	·24	·19	·25	·30	·23
30	·06	·11	·17	·08	·08	·21	·43	·17	·20	·07	·06	·10
31	·01	..	·01	·01	·01	·02	·28	·46	·34	·10	·04	·03
Total	2·75	3·24	3·17	2·64	2·73	3·86	4·18	4·67	3·99	2·92	3·23	3·73
From Jan. 1	9·60	12·38	11·08	11·15	11·01	12·22	13·29	14·28	13·12	10·50	11·49	12·81

Daily Rainfall. August, 1891.

Day of Month	Dorking	ReigateHill	Caterham	Marden Park	Kenley	Purley (Reedham)	Purley (Tudor C.)	Banstead	Ashtead	Sutton	Carshalton	Wallington	Beddington	Waddon	Croydon (Brim. Bn.)	Croydon (Limes Rd.)	Croydon (Whitgift)	Addiscmb. (Hvlk. Rd.)	Addiscmb. (Outm. Rd.)	Addington Hills	Addington (Park Fm.)	Addington (Pump. St.)	West Wickham	Hayes Common	Keston (Bradfield)
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	·02	·03	·03	·03	·03	·04	..	..	..	..	..	..	·01	..	..	..	..	..	·02	..	·03	..	·02	·01
2	·23	·18	·16	·13	·24	·35	·45	·47	·58	·62	·65	·67	·68	·63	·65	·67	·74	·66	·64	·42	·43	·56	·37	·38	·43
3	..	·03	·25	·29	·88	·93	1·04	·73	1·20	·67	·30	·65	·37	·38	·40	·44	·46	·55	·55	·78	·83	·73	·65	·68	·76
4	·14	·07	·07	..	·11	·10	·11	·08	·12	·09	·06	·07	·07	·07	·08	·06	·06	·07	·06	·10	·13	·10	·07	·09	·07
5	..	·01	..	..	·02	·02	·04	..	·02	·03	·02	·01	·02	·03	..	·02	·02	·02	..	·02	..	·01	..	·02	·02
6	..	·01	·03	·11	·02	·02	·03	..	..	..	·01	·02	·01	·01	·04	..	..	..	..	·01	·02	·01	·03	·01	·02
7	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
8	·06	·06	·05	·02	·02	·03	·02	·03	·05	·04	·02	·02	·02	·02	·03	..	·02	·03	·02	·02	·01	·01	..	..	..
9	·02	·11	·07	·05	·02	·01	·03	·07	·04	·02	·01	·02	·02	·01	·02	·04	·01	·01	·02	·01	·01	·01	·02	·01	·01
10	·08	·23	·21	·08	·15	·15	·12	·30	·26	·12	·02	·15	·06	·11	·12	·12	·12	·08	·09	·17	·13	·24	·16	·09	·07
11	·16	·15	·20	·14	·12	·10	·13	·13	·10	·08	·05	·08	·07	·05	·05	·06	·05	·07	·06	·09	·09	·10	·09	·06	·06
12	..	..	..	..	·01	..	·01	..	..	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..
13	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
14	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·07
15	..	·01	..	..	·03	·03	·02	..	..	..	..	·01	..	..	·01	..	..	..	·01	·03	·07	·04	·02	·04	..
16	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
17	·08	·19	·22	·25	·23	·17	·13	·06	·07	·07	·12	·13	·11	·12	·12	·12	·15	·16	·16	·17	..	·18	·21	·17	·16
18	·31	·45	·37	·37	·23	·27	·28	·28	·28	·27	·21	·21	·18	·15	·15	·15	·19	·24	·23	·28	·19	·23	·25	·24	·11
19	..	·04	..	·05	·05	·04	·06	·01	·08	·08	·09	·14	·14	·10	·19	·09	·08	·09	·08	·04	·06	·04	·05	·04	·21
20	1·95	1·86	1·45	1·32	1·17	·93	1·15	1·29	1·40	1·01	1·07	1·03	1·12	1·03	·96	1·19	1·14	1·06	1·03	·99	·83	·96	1·23	·84	·96
21	·10	·11	·25	·17	·28	·29	·24	·19	·18	·21	·10	·20	·15	·15	·13	·09	·06	·13	·13	·15	·28	·21	·17	·17	·18
22	·06	·09	·10	·08	·10	·08	·05	·09	·09	·08	·08	·09	·08	·08	·09	·07	·07	·08	·07	·08	·08	·07	·08	·07	·08
23	·08	..	..	·01	·06	·09	·14	..	·09	..	·09	·11	·08	·05	·03	·02	·03	·03	·02	·03	·02	·02	·01	..	..
24	·07	·06	·05	·04	·06	·05	·06	·04	·07	·05	·04	·05	·05	·05	·06	·04	·04	·05	·04	·05	·04	·04	..	·04	·04
25	·25	·26	..	·19	·25	·15	·17	·15	·08	·08	·04	·10	·10	·07	·06	·08	·07	·11	·11	·13	·23	·20	·25	·14	·11
26	·36	·48	·58	·26	·38	·33	·32	·32	·19	·18	·34	·26	·24	·21	·21	·33	·23	·24	·23	·29	·14	·21	·12	·15	·13
27	·72	·66	·63	·46	·61	·52	·50	·57	·66	·54	·35	·45	·45	·46	·40	·40	·50	·47	·47	·49	·56	·52	·54	·46	·36
28	·09	·20	·12	·18	·15	·08	·07	·04	·05	·05	·04	·05	·05	·05	·05	·02	·04	·05	·05	·07	·13	·15	·25	·11	·18
29	·05	·06	·10	..	·10	·10	·06	·06	·07	·05	·03	·03	·03	·03	·04	·02	·03	·03	·03	·06	·09	·12	·15	·06	·06
30	·07	·05	·07	·09	·07	·06	·12	·06	·07	·07	·06	·06	·06	·06	·06	·06	·06	·06	·06	·05	·06	·05	·02	·04	·05
31	·44	·49	·65	·60	·41	·29	·25	·28	·22	·20	·16	·21	·20	·18	·18	·19	·20	·22	·22	·25	·31	·33	·41	·25	·21
Total	5·32	5·89	5·66	4·91	5·80	5·32	5·64	5·25	5·97	4·61	3·96	4·82	4·36	4·12	4·13	4·28	4·37	4·51	4·38	4·80	4·74	5·17	5·15	4·18	4·36
From Jan. 1	20·15	22·49	22·14	19·90	20·69	19·63	21·24	18·94	19.14	17·52	16·88	18·38	17·96	17·09	16·62	17·38	18·28	17·65	17·28	17·97	18·95	18·76	20·19	17·95	18·23

Daily Rainfall. **August, 1891.**

Day of Month	Keston (Heathfd.)	Keston (Tow. Fds.)	Orpington	Farningham Hill	Wilmington	Chislehurst	Bickley	Beckenham	South Norwood	Wimbledon (Sew. Wks.)	Wimbledon (Mt. Ararat)	Raynes Park	New Malden
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	..	..	..	..	·01	·02	..	·01	..	..	·01	RECORD CEASED.
2	·45	·50	·12	·21	·28	·48	·60	·64	·66	·60	·38	·53	
3	·82	·75	·53	·45	·13	·32	·32	·25	·58	·04	·10	·19	
4	·05	·07	·03	·10	·05	·06	·10	·05	·06	·12	·16	·13	
5	·02	..	·02	·02	·01	·02	·02	·01	·03	·03	..	·02	
6	·01	·02	..	·05	·03	·03	·02	·02	·01	..	·02	·01	
7	..	..	..	..	..	..	..	..	..	..	..	..	
8	·03	..	..	..	·01	·01	·01	·01	·03	·03	·05	·05	
9	·02	·01	.	·03	..	·01	..	·01	·02	·04	·05	·05	
10	·08	·08	·01	·10	..	·10	·11	·10	·13	·45	·10	·10	
11	·08	·07	·02	·02	..	·06	·05	·02	·05	·05	·05	·05	
12	..	..	..	..	..	..	..	..	..	..	..	..	
13	..	..	..	..	..	..	..	..	..	..	..	..	
14	..	..	..	..	..	..	..	..	..	..	..	..	
15	·06	·10	..	[illegible]	..	·02	..	·01	·01	·02	·01	..	
16	..	..	..	..	..	..	..	..	..	..	..	..	
17	·20	·16	·15	·04	..	·17	·21	·15	·17	·14	·09	·10	
18	·26	·12	·07	·03	·08	·26	·30	·16	·16	·16	·25	·24	
19	·06	·22	·10	·04	·20	·07	·11	·11	·12	·15	·22	·19	
20	1·03	·95	1·10	1·25	·30	·88	·88	·85	1·20	1·32	1·42	1·38	
21	·20	·22	·16	·07	·20	·08	·07	·10	·11	·09	·10	·08	
22	·08	·09	·07	·13	·08	·12	·11	·08	·10	·04	·05	·06	
23	..	..	·02	..	..	·01	..	..	·01	·04	·05	·07	
24	·05	·04	·03	·03	·05	·04	·05	·05	·07	·08	·10	·10	
25	·17	·15	·11	·10	·03	·07	·07	·04	·07	·04	·06	·06	
26	·19	·15	·10	·09	·04	·11	·12	·16	·30	·20	·15	·16	
27	·47	·41	·27	·24	·17	·34	·41	·43	·35	·66	·70	·68	
28	·17	·21	·11	·10	·07	·07	·07	·02	·03	·02	·03	·03	
29	·07	·07	·10	·11	·01	·06	·05	·03	·05	·02	·03	·03	
30	·06	..	·05	·03	·06	·04	·04	·05	·08	·07	·09	·09	
31	·33	·33	·20	·18	·13	·20	·19	·13	·17	·20	·20	·20	
Total	4·96	4·72	3·37	3·50	1·93	3·64	3·93	3·48	4·58	4·61	4·46	4·61	
From Jan. 1	20·02	20·17	15·68	17·12	14·19	16·32	17·63	14·06	..	17·23	16·29	17·71	

Day of Month	Esher	Surbiton	Kingston	Richmond	Kew	Brixton	West Norwood	Sydenham	Forest Hill	Deptford	Greenwich	Eltham
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	..	·05	..	..	..	..	..	..	DAILY RECORD MISLAID.	..	..
2	·41	·40	·57	·40	·32	·87	·45	·33	·56		·89	·64
3	·07	·05	·18	·03	·02	·01	·11	·07	·07		·03	·12
4	·40	·28	·34	·35	·36	·15	·06	·47	·30		·06	·06
5	..	·01	·02	·02	·01	·01	·02	·03	..		·02	·03
6	·01	..	..	..	..	·02	·01	..	·03		·03	·03
7	·01	..	..	..	..	..	..	..	..		..	..
8	·03	·05	·07	·09	·08	..	·02	·03	·01		·02	·01
9	·02	..	·05	·09	·05	·11	·04	·03	·02		·13	·06
10	·07	·05	·06	·16	·13	·07	·12	·10	·13		·05	·10
11	·03	·04	·04	·05	·05	·05	·05	·06	..		·07	·06
12	..	..	..	..	..	..	..	..	..		..	..
13	..	..	..	..	..	..	..	..	..		..	..
14	..	..	..	..	..	..	..	..	..		..	..
15	..	..	..	·01	·01	·01	..	..	..		·04	·01
16	..	..	..	..	..	..	..	..	..		..	..
17	·05	·01	·08	·08	·09	·22	·21	·23	·21		·21	·21
18	·10	·37	·25	·14	·10	·07	·13	·12	·13		·11	·29
19	·06	·11	·10	·17	·15	·30	·08	·05	·07		·13	·07
20	1·06	1·19	1·37	1·17	1·16	1·38	1·19	1·19	1·11		·95	·95
21	·16	·04	·13	·05	·04	·10	·10	·12	·04		·04	·08
22	..	·06	·05	·03	·02	·03	·07	·07	·02		·02	·10
23	·01	..	..	·07	·09	..	..	·02	..		..	·01
24	·05	·08	·10	·10	·10	·06	·09	·07	·09		·07	·08
25	·02	·07	·05	·05	·04	·03	·02	·03	·03		·03	·05
26	·14	·16	·22	·20	·28	·13	·17	·18	·18		·17	·15
27	·62	·81	·79	·64	·54	·66	·44	·47	·41		·39	·44
28	·07	·04	·06	..	..	·01	·03	..	·03		·02	·01
29	·02	..	·02	..	·08	..	·02	·05	..		·01	·05
30	·07	·11	·11	·16	·18	·07	·06	·06	·11		·07	·05
31	·10	·21	·23	·18	·16	·19	·17	·20	·13		·21	·17
Total	3·58	4·17	4·94	4·24	4·06	4·55	3·66	3·98	3·68	3·36	3·77	3·83
From Jan. 1	13·18	16·55	16·02	15·39	15·07	16·77	16·95	18·26	16·80	13·86	15·26	16·64

Daily Rainfall. September, 1891.

Day of Month	Dorking	ReigateHill	Caterham	Marden Park	Kenley	Purley (Reedham)	Purley (Tudor C.)	Banstead	Ashtead	Sutton	Carshalton	Wallington	Bedding-ton	Waddon	Croydon (Brim. Bn.)	Croydon (Limes Rd.)	Croydon (Whitgift)	Addiscomb. (Hvlk. Rd.)	Addiscomb. (Outm.Rd.)	Addington Hills	Addington (Park Fm.)	Addington (Pump. St.)	West Wickham	Hayes Common	Keston (Bradfield)
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	..	..	..	·01	..	·02	..	..	..	..	..	..	·01	..	..	..	..	..	..	·09	..	·01	..	..
2	·10	..	..	..	·05	·05	·03	·02	·01	..	..	·01	..	..	..	..	..	·01	·01	·03	·06	·03	..	·03	·03
3	..	·02	·03	·03	·07	·04	·02	..	·04	..	..	..	·01	..	..	·01	·02	·01	·02	·02	·02	·02	·04	..	·02
4	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
6	·10	·07	..	·04	·06	·05	·05	·08	·13	·09	·05	·07	·07	·06	·06	·05	·06	·07	·06	·06	..	·04	..	·05	·04
7	..	..	..	..	·02	..	·03	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
9	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
11	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
12	..	..	..	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
13	·02	·03	·06	..	..	·02	..	..	·01	·01	·02	·02	·02	·01	..	·01	·01	·01	·01	·01	..	·01	..	·01	·01
14	·29	·19	·17	·15	·18	·16	·20	..	·10	·10	·06	·09	·07	·09	·08	·09	·11	·11	·10	·14	·25	·17	·15	·16	·16
15	..	·02	·03	·02	·01	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	·01	..	·04	..	·01
16	..	..	..	..	..	..	..	·10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
17	·14	·16	·17	·13	·12	·10	·11	·06	·13	·10	·09	·10	·09	·09	·10	·09	·09	·11	·11	·11	·11	·12	·15	·11	·06
18	·08	·10	·10	·09	·08	·08	·06	·11	·06	·05	·04	·05	·04	·04	·05	·04	·04	·05	·05	·06	·04	·05	·07	·06	·08
19	·14	·15	..	·11	·09	·09	·10	·06	·12	·10	·08	·10	·10	·08	·09	·09	·09	·10	·10	·10	·07	·08	·10	·06	·06
20	·08	·06	·05	·05	·07	·06	·06	·14	·09	·05	·05	·05	·06	·05	·05	·04	·04	·04	·04	·06	·06	·04	·04	·04	·04
21	·27	·13	·16	·16	·17	·15	·12	·11	·17	·10	·07	·08	·07	·07	·05	·06	·05	·05	·05	·09	·11	·13	·14	·09	·10
22	·17	·03	·03	·05	·02	·04	·06	..	·08	·27	·08	·04	·05	·04	·06	·04	·04	·04	·03	·03	·04	·03	·05	·06	·07
23	..	·01	..	·01	·01	..	·10	·07	·01	..	..	..	..	..	..	..	..	..	..	·01	·01	..	·01	·01	..
24	·13	·17	·16	·13	·11	·10	·11	..	·11	·07	·04	·06	·06	·05	·05	·05	·06	·07	·07	·08	·08	·09	·09	·07	·08
25	..	..	..	·04	·01	..	·02	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
26	·08	·05	·05	..	·05	·04	·04	..	·07	·03	·03	·03	·03	·02	..	·02	·02	·02	·02	·02	·03	·03	·02	·02	·01
27	..	..	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
28	..	..	..	..	..	..	·01	·03	..	..	..	..	..	..	·03	..	..	..	..	..	..	..	..	..	..
29	·03	·03	·04	..	·04	·03	·03	·03	·05	·05	·04	·05	·04	·04	..	·03	·03	·03	·02	·03	·04	·02	·02	·01	·02
30	·04	·07	·05	·05	·05	·04	·05	·02	·05	·01	..	·01	·01	·02	..	·02	·02	·02	·02	·03	·01	·02	..	·06	·01
Total	1·67	1·29	1·10	1·06	1·22	1·05	1·23	·84	1·25	1·03	·65	·76	·72	·67	·62	·64	·68	·74	·71	·88	1·03	·88	·93	·84	·80
From Jan.1	21·82	23·78	23·24	20·96	21·91	20·68	22·47	19·78	20.39	18·55	17·53	19·14	18·68	17·76	17·24	18·02	18·96	18·39	17·99	18·85	19·98	19·64	21·12	18·79	19·03

Daily Rainfall.

September, 1891.

Day of Month	Keston (Heathfd.)	Keston (Tow. Fds.)	Orpington	Farningham Hill	Wilmington	Chislehurst	Bickley	Beckenham	South Norwood	Wimbledon (Sew. Wks.)	Wimbledon (Mt. Ararat)	Raynes Park
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	..	·02	..	·05	·01	..	..	..	·01	..	..
2	·02	·02	..	..	·05	·01	..	..	..	·01	·01	..
3	·02	·02	..	·06	·08	·02	·01	..	·01	..	·04	·04
4	..	..	..	·01	·01	..	..	..	..	..	..	..
5	..	..	..	..	..	..	..	..	..	..	·01	..
6	·05	·05	..	·01	·02	·06	·06	·08	·08	·15	·15	·14
7	..	..	..	·01	..	·01	..	..	..	..	..	..
8	..	..	..	..	..	..	..	..	..	..	..	..
9	..	..	..	..	..	..	..	..	..	..	..	..
10	..	..	..	·01	..	..	..	..	..	..	..	..
11	..	..	..	..	..	..	..	..	..	..	..	..
12	..	..	..	..	..	..	..	..	..	..	..	..
13	·02	·01	..	..	..	·01	·04	·02	·02	·05	·03	·04
14	·18	·19	·12	·15	·10	·12	·11	·07	·08	·07	·08	·06
15	·02	..	..	·01	..	..	..	..	..	·02	·02	..
16	..	..	..	·01	..	..	..	..	..	..	..	..
17	·18	·11	·03	·05	·07	·10	·10	·10	·12	·12	·11	·12
18	·05	·05	·01	·04	·02	·05	·05	·05	·07	·08	·08	·07
19	·09	·07	·01	·03	·09	·10	·10	·07	·09	·20	·22	·19
20	·05	·04	..	·05	·03	·07	·09	·06	·09	·06	·07	.09
21	·13	·12	·08	·14	·04	·06	·06	·05	·07	·08	·10	·10
22	·07	·07	·01	·14	·05	·05	·05	·03	·09	·27	·12	·23
23	..	..	·02	..	..	..	..	..	..	..	·01	..
24	·08	·07	·01	·08	·07	·09	·10	·05	·07	·08	·07	..
25	..	..	·01	..	..	..	..	..	..	..	..	·08
26	·03	·01	..	..	..	·02	·02	·01	·03	·03	·04	·05
27	..	..	..	..	..	..	..	..	..	..	·01	..
28	..	..	..	·01	..	..	..	..	..	..	..	..
29	·04	·03	..	·01	·01	·03	..	..	·03	..	·03	·03
30	·03	..	..	·03	..	·02	·01	·03	·02	..	·02	·03
Total	1·06	·86	·32	·85	·69	·83	·80	·62	·87	1·23	1·22	1·27
From Jan. 1	21·08	21·03	16·00	17·97	14·88	17·15	18·43	14·68	..	18·46	17·51	18·98

Day of Month	New Malden	Esher	Surbiton	Kingston	Richmond	Kew	Brixton	West Norwood	Sydenham	Forest Hill	Deptford	Greenwich	Eltham
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1		..	..	..	..	..	..	..	..	..	..	..	
2		·11	..	..	..	·01	..	..	..	..	..	..	
3		..	·01	·01	·04	·02	..	·03	..	..	..	..	
4		..	..	..	..	..	..	..	..	..	..	..	
5		..	..	..	..	..	..	..	..	..	..	..	
6		·09	·11	·16	·10	·13	·11	·09	·10	·09	·06	·06	
7		..	..	..	..	..	..	..	..	..	..	..	
8		..	..	..	..	..	..	..	..	..	..	..	
9		..	..	..	..	·01	..	..	..	..	..	..	
10		..	..	..	..	·01	..	..	..	..	..	..	
11		..	..	..	..	·01	..	..	..	..	..	..	
12		..	..	..	..	..	..	..	..	..	..	..	
13		..	·01	·10	·03	·05	..	..	..	·01	·05	·04	
14		·09	·09	·19	·08	·09	·12	·06	·11	·10	·09	·11	
15		·01	·01	·02	·02	·02	·01	..	..	..	..	..	
16	RECORD CEASED.	..	..	..	..	..	..	..	..	..	..	..	RECORD CEASED.
17		·05	·07	·09	·13	·12	·11	·12	..	·11	·10	·09	
18		·08	·08	·07	·08	·07	·06	·07	..	·09	·04	·05	
19		·21	·19	·29	·25	·20	·25	·16	..	..	·14	.15	
20		·06	·09	·08	·06	·03	·05	·05	·10	·19	·01	·04	
21		·08	·06	·07	·03	·02	·03	·15	·07	·15	.08	.08	
22		·02	·11	·12	·07	·03	·17	·03	..	·10	·12	·04	
23		..	..	..	..	·01	..	..	·23	·10	..	..	
24		·07	·07	·08	·10	·09	·08	·09	..	·10	·07	·07	
25		·01	..	..	..	..	..	..	..	·03	..	..	
26		·02	·02	·12	·03	·03	·03	·03	..	..	·02	·02	
27		..	..	..	..	·01	..	..	..	..	..	..	
28		..	..	..	..	..	..	..	·11	..	..	..	
29		·01	·02	..	..	·02	·02	·03	..	·03	·02	·02	
30		·02	·04	·03	·09	·06	·02	..	·05	·01	·01	..	
Total		·93	·98	1·43	1·11	1·04	1·06	·91	·77	1·11	·81	·77	
From Jan. 1		14·11	17·53	17·45	16·50	16·11	17·83	17·86	19·03	17·91	14·67	16·03	

Day of Month	Dorking	Reigate Hill	Caterham	Marden Park	Kenley	Purley (Reedham)	Purley (Tudor C.)	Banstead	Ashtead	Sutton
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·44	OBSERVATIONS IRREGULAR.	·29	·30	·26	·26	·27	·34	·31	·28
2	..		..	..	..	..	..	..	..	..
3	..		..	..	..	..	·01	..	..	..
4	..		..	..	..	..	..	..	·13	..
5	·15		·09	..	·06	·06	·07	·08	·73	·08
6	·89		·87	·94	·90	·81	·89	·75	·35	·71
7	·50		..	·30	·23	·28	·32	·41	·08	·34
8	·26		·22	·15	·25	·17	·17	·22	·05	·11
9	..		·02	·01	·02	·01	·03	..	..	..
10	·40		·50	·61	·44	·36	·35	·35	·25	·29
11	·31		·35	·31	·35	·28	·26	·35	·21	·26
12	·16		·18	·13	·17	·18	·18	·13	·10	·10
13	·78		·91	·79	·99	·74	·68	·77	·60	·63
14	·35		·17	·27	·24	·28	·25	·22	·33	·40
15	·54		·55	·53	·69	·60	·62	·75	·54	·50
16	·37		·17	·19	·20	·18	·19	·16	·26	·19
17	·08		·01	·06	..	..	·02	..	..	..
18	·28		·22	·11	·18	·15	·20	·19	·22	·16
19	·32		·35	·34	·35	·26	·27	·31	·27	·25
20	·13		·10	·02	·04	·04	·08	·05	·05	·03
21	·73		·87	.82	·74	·63	·77	·53	·60	·50
22	·55		·56	·53	·62	·53	·50	·57	·51	·48
23	·01		..	..	·01	..	·01	..	..	..
24	..		..	..	·01	..	..	..	..	..
25	·17		·12	·12	·13	·15	·17	·16	·17	·18
26	·27		·43	·41	·22	·36	·40	·30	·23	·29
27	..		·01	·01	·02	·02	·05	·02	·01	·01
28	..		..	..	..	..	..	..	..	..
29	..		..	..	..	·01	..	..	..	..
30	..		..	..	..	..	..	..	..	..
31	..		..	..	..	..	..	..	..	..
Total	7·69	7·29	6·99	6·95	7·12	6·36	6·76	6·66	6·00	5·79
From Jan. 1	29·51	31·07	30·23	27·91	29·03	27·04	29·23	26·44	26.39	24·34

Day of Month	Carshalton	Wallington	Beddington	Waddon	Croydon (Brim. Bn.)	Croydon (Limes Rd.)	Croydon (Whitgift)	Addiscmb. (Hvlk. Rd.)	Addiscmb. (Outm. Rd.)	Addington Hills	Addington (Park Fm.)	Addington (Pump. St.)	West Wickham	Hayes Common	Keston (Bradfield)
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·30	·32	·28	·25	·30	·25	·25	·27	·26	·25	·26	·25	·32	·24	·25
2	..	..	..	..	..	..	..	·01	..	..	..	..	..	..	..
3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
4	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
5	·06	·06	·06	·06	..	·06	·06	·05	·04	·07	·06	·05	·06	·05	·05
6	·70	·77	·78	·74	·74	·76	·80	·75	·75	·81	·78	·84	·72	·70	·63
7	·33	·37	·33	·34	·35	·34	·36	·29	·28	·18	·18	·23	·38	·13	·33
8	·06	·13	·11	·09	·08	·10	·11	·11	·13	·12	·17	·16	·16	·12	·10
9	..	..	..	·02	..	·01	..	·01	..	..	·01	·01	·01	·01	·01
10	·27	·28	·27	·24	·24	·25	·26	·29	·29	·35	·34	·41	·55	·39	·54
11	·23	·26	·24	·21	·18	·23	·26	·26	·26	·30	·36	·36	·35	·31	·32
12	·10	·13	·10	·13	·13	·14	·14	·15	·14	·14	·11	·11	·13	·09	·06
13	·50	·69	·67	·61	·55	·61	·78	·65	·71	·74	·83	·73	·61	·69	·64
14	·36	·20	·15	·28	·15	·26	·15	·23	·22	·30	·26	·27	·32	·22	·32
15	·52	·70	·79	·54	·73	·55	·68	·63	·66	·56	·56	·55	·44	·46	·37
16	·18	·16	·16	·19	·18	·20	·20	·20	·21	·17	·16	·16	·29	·13	·17
17	..	..	..	..	·01	..	..	·01	·01	..	..	..	·01	..	..
18	·16	·17	·16	·15	·10	·20	·16	·17	·18	·15	·11	·17	·05	·16	·16
19	·20	·26	·27	·25	·22	·21	·26	·26	·26	·40	·41	·34	·44	·31	·35
20	·07	·04	·06	·07	·06	·10	·05	·02	·03	·03	·03	·01	·03	·02	·80
21	·61	·57	·61	·60	·45	·65	·58	·60	·58	·72	·91	·97	·81	·81	·74
22	·35	·52	·50	·46	·40	·39	·49	·48	·52	·56	·64	·53	·58	·50	·61
23	..	..	..	..	..	..	..	·01	..	..	·02	..	..	..	..
24	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..
25	·16	·17	·17	·17	·18	·18	·25	·16	·18	·16	·17	·15	·17	·15	·14
26	·31	·35	·37	·30	·25	·39	.36	·38	·44	·40	·43	·37	·55	·50	·64
27	·01	·01	·01	·01	·01	·01	·01	·01	·01	·02	·04	·01	·02	·03	·03
28	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	..
29	..	·01	..	..	..	..	..	·01	..	·01	..	·01	..	..	..
30	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
31	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Total	5·48	6·17	6·09	5·71	5·31	5·89	6·21	6·01	6·16	6·45	6·84	6·70	7·00	6·02	6·76
From Jan. 1	23·01	25·31	24·77	23·47	22·55	23·91	25·17	24·40	24·15	25·30	26·82	26·34	28·12	24·81	25·79

Daily Rainfall. **October, 1891.**

Day of Month	Keston (Heathfd.)	Keston (Tow. Fds.)	Orpington	Farningham Hill	Wilmington	Chislehurst	Bickley	Beckenham	South Norwood	Wimbledon (Sew. Wks.)	Wimbledon (Mt. Ararat)	Raynes Park
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·28	·29	·18	·28	·22	·24	·22	·24	·23	·37	·37	·35
2	..	..	·01	..	·07	..	..	..	..	..	..	..
3	..	..	..	·01	·09	..	..	..	..	..	·01	..
4	..	..	..	..	·02	..	·01	..	..	..	·01	..
5	·06	..	·02	·07	·05	·04	·05	·03	·05	·04	·08	·05
6	·72	·74	·53	·45	·42	·58	·62	·62	·71	·59	·67	·64
7	·37	·35	·40	·33	·19	·29	·15	·22	·30	·34	·55	·44
8	·17	·14	·16	·14	·07	·08	·10	·04	·08	·02	·04	·04
9	·01	·02	·03	·03	·02	·01	·01	..	..	..	..	..
10	·57	·53	·51	·30	·41	·42	·34	·23	·24	·22	·26	·25
11	·39	·37	·33	·34	·25	·30	·32	·20	·23	·14	·16	·17
12	·08	·09	·09	·06	·04	·07	·09	·09	·15	·05	·06	·07
13	·75	·74	·60	·47	·46	·57	·65	·49	·56	·32	·38	·42
14	·40	·38	·18	·12	·14	·29	·42	·13	·35	·15	·13	·15
15	·42	·43	·45	·50	·30	·44	·47	·50	..	·44	·47	·55
16	·20	·19	·16	·13	·12	·10	·15	·18	·52	·24	·18	·21
17	..	..	..	·01	..	..	..	..	·01	..	..	..
18	·20	·13	·16	·20	·12	·17	·22	·10	·17	·16	·20	·16
19	·36	·41	·25	·33	·23	·32	·42	·25	·24	·28	·25	·28
20	·03	·03	..	·07	·06	·01	·02	·01	·08	·04	·13	·06
21	·80	·72	·65	·76	·71	·63	·73	·49	·60	·45	·38	·50
22	·55	·62	·47	·49	·34	·48	·45	·44	·40	·46	·52	·49
23	..	..	..	..	..	..	·01	..	..	..	·01	..
24	..	..	..	·01	..	..	..	..	·01	..	..	..
25	·15	·16	·06	·15	·17	·13	·21	·15	·19	·30	·20	·19
26	·57	·50	·47	·46	·46	·27	·50	·37	·38	·35	·36	·32
27	·02	·03	·02	..	·02	..	·02	..	·01	·01	·01	·01
28	..	..	..	..	..	..	..	..	..	..	..	..
29	·01	..	..	..	..	..	·01	..	..	..	..	..
30	..	..	..	..	..	..	..	..	..	..	..	..
31	..	..	..	..	..	..	..	..	..	..	..	..
Total	7·11	6·87	5·71	5·71	4·98	5·47	6·18	4·78	5·51	4·97	5·43	5·35
From Jan. 1	28·19	27·90	21·71	23·68	19·86	22·62	24·61	19·46	..	23·43	22·94	24·33

Day of Month	New Malden	Esher	Surbiton	Kingston	Richmond	Kew	Brixton	West Norwood	Sydenham	Forest Hill	Deptford	Greenwich	Eltham
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	RECORD CEASED.	·44	·37	·47	·58	·60	·42	·34	RECORD CEASED.	·35	·34	·29	RECORD CEASED.
2		·01	..	..	..	·01	..	..		..	..	..	
3		..	..	..	..	·01	..	..		..	..	..	
4		..	..	..	..	..	..	..		..	..	..	
5		·11	·08	·08	·08	·08	·02	·04		·03	·01	·01	
6		·37	·63	·79	·64	·64	·59	·68		·61	·51	·51	
7		·06	·50	·59	·54	·72	·30	·34		·24	·22	·18	
8		·02	·02	·01	·03	·02	·01	·02		..	·01	·01	
9		·01	..	..	..	..	..	..		..	..	..	
10		·25	·23	·27	·29	·27	·22	·22		·29	·24	·26	
11		·12	·11	·10	·16	·15	·16	·19		·20	·14	·13	
12		·20	·11	·12	·14	·16	·09	·12		·15	·07	·06	
13		·43	·44	·39	·44	·37	·29	·38		·37	·27	·29	
14		·14	·14	·14	·17	·12	·09	·28		·16	·25	·21	
15		·53	·47	·46	·44	·42	·54	·46		·60	·41	·50	
16		·09	·11	·09	·11	·11	·17	·10		·14	·13	·12	
17		..	..	..	·02	·01	..	..		..	..	..	
18		·06	·14	·19	·25	·24	·14	·12		·15	·12	·12	
19		·16	·26	·27	·26	·24	·34	·27		·27	·26	·27	
20		·07	·02	·07	·04	·18	·02	·02		·08	·02	·01	
21		·50	·61	·78	·74	·67	·40	·46		·45	·44	·41	
22		·45	·50	·49	·50	·43	·51	·44		·39	·36	·39	
23		·01	..	..	..	·01	..	..		..	..	..	
24		·02	..	..	..	..	..	..		..	..	..	
25		·10	·15	·20	·17	·17	·20	·16		·18	·20	·21	
26		·17	·25	·20	·29	·24	·35	·39		·40	·31	·33	
27		·02	..	..	..	..	..	·01		·03	..	..	
28		..	..	..	..	..	..	..		..	..	..	
29		..	..	..	..	..	..	..		..	..	..	
30		..	..	..	..	..	..	..		..	..	..	
31		..	..	..	·01	·01	..	..		..	..	..	
Total		4·34	5·14	5·71	5·90	5·88	4·86	5·04		5·09	4·31	4·31	
From Jan. 1		18·45	22·67	23·61	22·40	21·29	22·69	22·90		23·00	18·98	20·34	

Daily Rainfall. November, 1891.

Day of Mnoth	Dorking	ReigateHill	Caterham	Marden Park	Kenley	Purley (Reedham)	Purley (Tudor C.)	Banstead	Ashtead	Sutton	Carshalton	Wallington	Bedding-ton	Waddon	Croydon (Brim. Bn.)	Croydon (Limes Rd.)	Croydon (Whitgift)	Addiscmb. (Hvlk. Rd.)	Addiscmb. (Outm. Rd.)	Addington Hills	Addington (Park Fm.)	Addington (Pump. St.)	West Wickham	Hayes Common	Keston (Bradfield)
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	OBSERVATIONS IRREGULAR.	..	·01	·02	·01	·01	..	..	..	..	·01	..	..	..	..	..	·01	01	·02	·01	..	·02	·01	·01
2	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
3	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01
4	·02		·03	·02	·02	·02	·01	·01	·01	·03	·01	·01	·01	..	·02	·01	·02	..	·02	·02	..	·01	·01	·01	·01
5	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..
6	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
7	..		..	..	..	..	..	..	·01	..	..	·01	..	..	..	..	..	..	..	..	..	·01	..	..	·01
8	·02		·03	·03	·02	·04	·02	·01	·01	·04	·02	·01	..	·01	..	·02	..	..	·01	·02	·02	·02	..	·01	·01
9	·48		·45	·47	·47	·46	·58	·42	·36	·31	·30	·36	·38	·37	·35	·35	·38	·41	·42	·50	·43	·40	·47	·38	·13
10	1·07		1·10	·98	1·05	·88	1·06	·90	1·06	1·03	1·15	1·09	1·15	·97	·85	1·10	·98	·84	·93	·87	·77	·86	·72	·99	1·26
11	·45		·41	·47	·54	·37	·47	·57	·47	·49	·35	·48	·48	·37	·38	·25	·51	·44	·43	·43	·67	·45	·30	·43	·44
12	·60		·43	·41	·42	·38	·39	·48	·37	·38	·26	·35	·31	·31	·28	·32	·31	·30	·30	·35	·33	·37	·34	·31	·34
13	·03		·03	·01	·03	·03	·03	·04	·02	·02	·01	·04	·03	·03	·03	..	·04	·03	·02	·02	·02	·01	·01	·01	..
14	·07		·07	·07	·05	·04	·05	·09	·04	·05	·04	·02	·03	·03	·03	·08	·04	·06	·06	·06	·04	·04	·07	·05	·09
15	·10		·25	·14	·13	·13	·14	·27	·24	·16	·15	·18	·19	·19	·16	·15	·17	·15	·14	·20	·08	·19	·12	·12	·11
16	·12		·07	·05	·05	·06	·06	·07	·12	·06	·06	·05	·06	·06	·08	·07	·07	·05	·05	·08	·13	·07	·12	·04	·06
17	·10		·11	·08	·16	·09	·11	·07	·06	·05	·03	·07	·07	·06	·05	·02	·07	·07	·07	·09	·08	·09	·10	·09	·09
18	·10		·14	·11	·11	·05	·09	·07	·02	·01	·01	·02	·02	·01	·02	·01	·02	·02	·02	·03	·08	·07	·05	·02	·03
19	·02		..	·01	·01	·01	·01	·01	·01	..	..	·01	..	..	..	..	..	·01	..	..	..	..	·01	..	..
20	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
21	..		..	..	..	..	..	·01	·02	·02	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
22	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
23	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	·01	..	..	..	..
24	..		..	..	..	..	..	..	·02	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
25	·10		·08	·07	·10	·08	·05	·08	·08	·06	·05	·05	·05	·05	·05	·05	·06	·05	·05	·07	·06	·08	·10	·06	·09
26	·12		·08	·08	·07	·07	·07	·06	·06	·06	·06	·07	·06	·06	·06	·05	·05	·05	·05	·06	·07	·06	·07	·06	·05
27	..		..	..	·01	..	..	..	·02	..	..	..	..	·01	..	..	..	..	..	..	..	·01	..	..	..
28	·21		·25	·24	·21	·17	·14	·16	·09	·10	·09	·11	·11	·09	·09	·09	·10	·09	·08	·11	·09	·11	·10	·06	·06
29	·03		·07	·04	·06	·05	·08	·03	·05	·02	·02	·02	·02	·02	·02	·01	·03	·02	·02	·02	·02	·01	..	·03	·03
30	·02		·03	·03	·02	·02	·03	·01	·01	..	·01	·01	·01	·01	..	..	·02	·01	·01	·02	·03	·01	·05	·03	·03
Total	3·66	3·40	3·63	3·32	3·55	2·96	3·40	3·36	3·15	2·89	2·62	2·97	2·98	2·65	2·47	2·58	2·87	2·62	2·69	2·97	2·94	2·87	2·66	2·72	2·86
From Jan. 1	33·17	34·47	33·86	31·23	32·58	30·00	32·63	29·80	29·54	27·23	25·63	28·28	27·75	26·12	25·02	26·49	28·04	27·02	26·84	28·27	29·76	29·21	30·78	27·53	28·65

Day of Month	Keston (Heathfd.)	Keston (Tow. Fds.)	Orpington	Farningham Hill	Wilmington	Chislehurst	Bickley	Beckenham	South Norwood	Wimbledon (Sew. Wks.)	Wimbledon (Mt. Ararat)	Raynes Park
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·01	..	..	·02	..	..	·02	..	..	..	..	·01
2	..	..	..	..	..	..	..	..	..	..	..	..
3	..	..	..	..	..	..	·03	..	..	..	..	..
4	·01	·01	..	·01	..	..	..	·02	·01	..	·01	·02
5	..	..	..	..	..	..	..	..	..	..	..	..
6	..	..	..	..	..	..	..	..	..	..	..	..
7	..	..	..	..	..	..	..	..	..	..	..	..
8	·02	..	..	·01	..	..	..	·01	·04	·01	·01	·03
9	·48	·48	·37	·40	·34	·41	·47	·36	·32	·36	·37	·35
10	·93	·72	·77	·33	·48	·75	·85	·70	1·03	·52	·56	·66
11	·44	·74	·33	·60	·40	·38	·75	·40	·28	·54	·60	·70
12	·33	·32	·28	·15	·19	·23	·24	·20	·25	·19	·24	·23
13	..	·03	..	·09	·01	·01	·05	·01	·04	·01	·01	·02
14	·07	·07	·05	·04	·04	·03	·05	·03	·05	·03	·03	·03
15	·17	·11	·14	·14	·08	·10	·11	·06	·14	·13	·20	·20
16	·05	·07	·05	·01	·01	·05	·04	·02	·07	·06	·10	.06
17	·10	·09	·03	·06	·07	·10	·10	·06	·05	·06	·05	·08
18	·07	·06	·02	·03	..	·03	·02	..	·01	·01	·01	·01
19	..	..	..	·02	..	..	·01	..	..	..	..	·02
20	..	..	..	..	..	..	..	..	..	..	·01	·01
21	..	..	..	·01	..	..	..	..	..	..	·01	·02
22	·01	·01	..	·02	·01	·01	·03	·01	..	·01	..	..
23	..	..	..	..	.01	..	..	..	..	..	..	..
24	..	..	..	·01	..	·01	·02	..	..	..	..	..
25	·09	·09	·01	..	·03	·04	·05	·02	·05	·05	·05	·06
26	·06	·06	..	·10	·08	·05	·06	·05	·05	·06	·06	·05
27	..	..	..	·01	..	·01	..	..	..	..	..	·02
28	·08	·06	·02	·02	·02	·03	·04	·03	·06	·13	·12	·12
29	·03	·02	·02	·02	..	·02	·03	·01	·01	·02	·03	·03
30	·03	·04	..	·06	·02	·02	·01	·01	..	·01	·01	·02
Total	2·98	2·98	2·09	2·16	1·79	2·28	2·98	2·00	2·46	2·20	2·48	2·75
From Jan. 1	31·17	30·88	23·80	25·84	21·65	24·90	27·59	21·46	..	25·63	25·42	27·08

Day of Month	New Malden	Esher	Surbiton	Kingston	Richmond	Kew	Brixton	West Norwood	Sydenham	Forest Hill	Deptford	Greenwich	Eltham
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	..	..	..	..	..	·01	·01	RECORD CEASED.	..	·01	·01	RECORD CEASED.
2	..	..	..	..	..	..	..	..		..	..	..	
3	..	..	..	..	..	..	..	..		..	..	..	
4	..	·01	·01	..	..	..	..	·01		..	..	·01	
5	..	..	..	..	..	..	..	..		..	..	..	
6	..	..	..	..	..	..	..	..		..	..	..	
7	..	..	..	..	..	·01	..	..		..	..	..	
8	..	·01	·02	·03	..	·09	..	·01		..	·01	..	
9	·31	·29	·33	·31	·30	·22	·36	·38		·40	·42	·39	
10	·33	·52	·50	·56	·40	·45	·48	·88		·60	·44	·49	
11	·43	·54	·61	·61	·42	·27	·66	·47		·42	·53	·41	
12	·23	·25	·28	·20	·24	·25	·20	·20		·21	·35	·20	
13	..	·05	·04	·11	·04	·03	·01	·01		..	·02	·01	
14	·04	·02	..	·07	·04	·05	·04	·05		..	·10	·06	
15	·18	·15	·20	·26	·15	·11	·14	·09		·16	·13	·10	
16	·07	·03	·04	·08	·07	·09	·02	·07		·03	·03	·02	
17	·06	·05	·07	·06	·07	·04	·10	·07		·11	·07	·08	
18	..	·02	..	·01	·02	·01	·02	·01		..	·01	·01	
19	·02	·01	·02	·02	·01	·01	·01	..		..	..	..	
20	..	..	..	..	..	..	..	..		..	..	..	
21	..	..	·01	..	·01	·01	..	..		..	..	..	
22	..	..	..	..	..	·01	·01	..		..	..	·01	
23	..	..	..	..	..	..	..	..		..	..	..	
24	..	..	..	..	..	·01	..	..		..	..	..	
25	·05	·06	·06	·08	·06	·03	·06	·05		·07	·04	·05	
26	·04	·04	·03	·04	·08	·05	·06	·05		·06	·06	·06	
27	..	·01	..	..	..	·01	..	..		..	·01	..	
28	·06	·12	·11	·14	·15	·16	·13	·10		·09	·07	·08	
29	·03	·04	·03	·04	·03	·02	·02	·02		..	·02	·01	
30	..	·01	..	..	..	·01	·02	·02		..	·01	·01	
Total	1·85	2·23	2·36	2·72	2·09	1·94	2·35	2·50		2·15	2·33	2·01	
From Jan. 1	..	20·68	25·03	26·33	24·49	23·23	25·04	25·40		25·15	21·31	22·35	

Day of Mnoth	Dorking	ReigateHill	Caterham	Marden Park	Kenley	Purley (Reedham)	Purley (Tudor C.)	Banstead	Ashtead	Sutton	Carshalton	Wallington	Bedding-ton	Waddon	Croydon (Brim. Bn.)	Croydon (Limes Rd.)	Croydon (Whitgift)	Addiscmb. (Hvlk. Rd.)	Addiscmb. (Outm. Rd.)	Addington Hills	Addington (Park Fm.)	Addington (Pump. St.)	West Wickham	Hayes Common	Keston (Bradfield)
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	1·10	OBSERVATIONS IRREGULAR.	1·00	·99	1.20	1·03	1·13	1·19	·68	·94	·84	·94	·91	·86	·58	·88	·89	·85	·84	·94	·95	·99	·88	·83	·97
2	·10		·20	·06	·14	·06	·10	·07	·06	·04	·02	·05	·04	·04	·03	·04	·04	·04	..	·05	·02	·06	..	·04	·03
3	·09		·21	·12	·07	·04	·06	·02	·03	·02	·02	·03	·02	·03	·08	·02	·03	·03	·02	·04	·12	·07	·09	·03	·04
4	·10		·10	·07	·04	·03	·05	·02	·02	..	..	..	·01	·01	..	·01	·01	·02	·01	·02	·03	·03	·04	·02	·02
5	·25		·20	·17	·07	·14	·18	·15	·10	·09	·05	·10	·08	·07	·06	·07	·07	·07	·08	·11	·12	·17	·14	·08	·08
6	·43		·30	·31	·36	·38	·33	·35	·27	·31	·34	·35	·31	·33	·22	·32	·27	·28	·28	·19	·05	·30	·12	·27	·06
7	·15		·13	·08	·19	·15	·14	·10	·07	·05	·04	·10	·09	·09	·09	·04	·14	·10	·10	·14	·38	·17	·26	·16	·24
8	·37		·40	·34	·30	·27	·27	·28	·30	·21	·22	·21	·20	·20	·16	·23	·19	·21	·20	·27	·10	·31	·15	·29	·21
9	·08		·11	·11	·13	·09	·09	·08	·06	·08	·03	·07	·08	·06	·06	·03	·09	·06	·07	·10	·30	·10	·31	·10	·18
10	·50		·37	·33	·40	·40	·39	·45	·43	·35	·39	·39	.36	·36	·29	·37	·35	·38	·36	·40	·38	·38	·30	·32	·24
11	..		·08	..	..	..	..	..	·02	..	·01	..	..	·01		..	..	..	..	..	..	..	..	·01	..
12	·55		·50	·50	·64	·49	·58	·55	·32	·39	·33	·47	.51	·44	·19	·47	·54	·46	·50	·49	·38	·51	·47	·46	·25
13	·15		·25	·20	·27	·24	·20	·30	·34	·22	·19	·21	·20	·20	·16	·19	·20	·20	·18	·21	·35	·19	·18	·18	·30
14	·05		·04	·02	·03	·03	·04	·02	·06	·04	·04	·02	·01	·02	..	·02	·01	..	·01	·01	·01	·01	·01	·01	..
15	·06		..	·05	·05	·04	·05	·03	·04	·03	·01	·03	·03	·03	..	·02	·03	·03	·03	·03	·03	·03	·04	·04	·04
16	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
17	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	..
18	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
19	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
20	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	..
21	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
22	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
23	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
24	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
25	·04		..	·02	·03	·05	·03	·03	..	..	·04	·04	·01	..	..	·03	·01	·02	..	·03	·01	..	..	..	..
26	·44		·37	·32	·36	·29	·34	·37	·05	·28	·20	·27	·30	·25	.16	·23	·25	·24	·26	·26	·27	·29	·27	·27	·28
27	·26		·20	·19	·21	·17	·20	·19	·30	·17	·15	·18	·17	·16	.10	·15	·15	·13	·15	·15	·20	·20	·17	·14	·14
28	·09		·15	·12	·11	·09	·09	·06	·04	·04	·03	·04	·04	·04	·03	·03	·04	·05	·05	·07	·07	·07	·07	·05	·05
29	..		·09	·02	·02	·05	·03	..	·03	·02	·02	·01	·02	·02	·03	·03	·02	·03	·03	·03	·03	·02	·02	·03	·03
30	·18		·12	·21	·23	·15	·21	·17	·17	·20	·22	·22	·21	·20	·21	·19	·01	·21	·22	·20	·20	·20	·20	·20	·20
31	·12		·10	·11	·12	·16	·11	·12	·06	·11	·08	·11	·11	·11	·10	·14	·15	·12	·11	·14	·18	·16	·12	·16	·19
Total	5·11	5·06	4·92	4·34	4·97	4·35	4·62	4·55	3·45	3·59	3·27	3·84	3·71	3·53	2·55	3·51	3·49	3·53	3·50	3·88	4·18	4·28	3·84	3·69	3·55
From Jan.1	38·28	39·47	38·78	35·57	37·55	34·35	37·25	34·35	32·99	30·82	28·90	32·12	31·46	29·65	27·57	30·00	31·53	30·55	30·34	32·15	33·94	33·49	34·62	31·22	32·20

Daily Rainfall. December, 1891.

Day of Month	Keston (Heathfd.)	Keston (Tow. Fds.)	Orpington	Farningham Hill	Wilmington	Chislehurst	Bickley	Beckenham	South Norwood	Wimbledon (Sew. Wks.)	Wimbledon (Mt. Ararat)	Raynes Park
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·97	·93	·75	·56	·58	·69	·70	·62	·73	·56	·55	·58
2	·06	..	·09	·03	·01	·02	·03	·01	·02	·02	·01	·02
3	·07	·11	·02	·03	·01	·03	·02	·02	·02	·03	·06	·04
4	·03	·02	·02	·03	..	·01	·01	..	..	·02	..	·03
5	·13	·12	·06	·04	·01	·05	·05	·03	·05	·07	·07	·07
6	·23	·06	·26	·04	·09	·22	·25	·22	·29	·24	·32	·25
7	·19	·36	·06	·26	·18	·12	·15	·08	·04	·09	·05	·08
8	·33	·15	·12	·12	·10	·25	·24	·14	·21	·23	·24	·26
9	·13	·30	·21	·21	·20	·11	·10	·08	·04	·10	·09	·09
10	·31	·31	·28	·30	·34	·35	·37	·38	·42	·35	·35	·30
11	..	..	..	..	·05	·01	..	..	..	..	..	..
12	·56	·39	·36	·36	·22	·42	·45	·32	·42	·16	·21	·23
13	·21	·38	·18	·21	·25	·22	·22	·18	·20	·25	·26	·24
14	·01	..	..	·01	·07	·02	·02	·01	·01	·02	·02	·02
15	..	·05	..	·05	·02	·08	·10	·07	·06	·07	·08	·07
16	..	..	..	..	..	·01	..	..	..	..	..	·01
17	..	..	..	..	..	..	..	..	..	..	..	..
18	..	..	..	..	..	..	..	..	..	..	..	..
19	..	..	..	..	..	..	..	..	..	..	..	..
20	..	..	..	..	..	..	..	..	..	..	..	..
21	..	..	..	..	..	..	..	..	..	..	..	..
22	..	..	..	..	..	..	..	..	..	..	..	..
23	..	..	..	·01	..	..	..	..	..	..	..	..
24	..	..	..	·01	..	..	..	..	..	·05	..	·03
25	..	·02	..	..	·01	..	·04	·01	·03	·03	·07	·02
26	·31	·28	·21	·23	·09	·18	·18	·15	·19	·08	·10	·13
27	·16	·18	·11	·13	·14	·14	·17	·11	·12	·09	·10	·11
28	·08	·07	·05	·03	..	·05	·05	·04	·04	·05	·04	·04
29	·04	·05	·04	·05	·02	·08	·10	·08	·06	·07	·06	·05
30	·20	·22	·15	·16	·15	·24	·22	·21	·25	·24	·25	·26
31	·12	·17	·14	·16	·03	·09	·07	·06	·06	·05	·04	·03
Total	4·14	4·17	3·11	3·03	2·57	3·39	3·52	2·82	3·26	2·87	2·97	2·96
From Jan. 1	35·31	35·05	26·91	28·87	24·22	28·29	31·11	24·28	..	28·50	28·39	30·04

Day of Month	New Malden	Esher	Surbiton	Kingston	Richmond	Kew	Brixton	West Norwood	Sydenham	Forest Hill	Deptford	Greenwich	Eltham
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·43	·62	·62	·65	·60	·61	·59	·61	RECORD CEASED.	·60	·54	·58	RECORD CEASED.
2	·01	·02	·01	·02	·02	·01	·02	·02		..	·01	..	
3	·02	·04	·06	·03	·06	·05	·02	·03		·04	·02	·02	
4	·02	·02	..	..	..	·01	·03	·02		·02	·03	·03	
5	·03	·04	·04	·04	·04	·03	·08	·06		..	·06	·06	
6	·25	·20	·29	·29	·19	·21	·08	·12		·18	·18	·18	
7	·02	·07	·04	·02	·04	·01	·30	·20		·08	·07	·09	
8	·22	·19	·31	·36	·38	·42	·16	·16		·16	·13	·11	
9	·05	·02	·05	·04	·03	·03	·17	·08		·05	·11	·11	
10	·21	·14	·30	·36	·40	·41	·43	·35		·35	·37	·36	
11	..	..	..	..	..	..	..	..		..	..	..	
12	·14	·16	·21	·17	·17	·18	·22	·30		·30	·26	·27	
13	·18	·17	·23	·28	·25	·28	·22	·23		·23	·21	·22	
14	·04	·04	·03	·03	·02	·02	·01	·01		·10	·01	..	
15	·02	·04	·03	·06	·06	·04	·06	·09		..	·05	·05	
16	..	..	..	..	..	..	·01	..		..	..	..	
17	..	..	..	..	..	..	..	..		..	..	..	
18	..	..	..	..	..	..	..	..		..	..	..	
19	..	..	..	..	..	..	..	..		..	..	..	
20	..	..	..	..	..	..	..	..		..	..	..	
21	..	..	..	..	..	·01	..	..		..	..	..	
22	..	..	..	..	..	..	..	..		..	..	..	
23	..	..	..	..	..	..	..	..		..	..	..	
24	..	..	..	..	..	..	..	..		..	..	..	
25	..	·02	..	·10	·05	·03	·06	·05		·04	·05	..	
26	·13	..	·15	·11	·11	·11	·11	·14		·12	·11	·11	
27	·10	·08	·11	·12	·14	·13	·10	·10		·11	·15	·11	
28	·03	·03	·03	·04	·04	·03	·05	·04		·06	·07	·04	
29	·02	·01	..	·03	·05	·05	·06	·09		·04	·06	·05	
30	·17	·12	·23	·26	·22	·23	·26	·27		·27	·28	·27	
31	·01	·04	·02	·02	·04	·02	·03	·03		·04	·07	·01	
Total	2·10	2·07	2·76	3·03	2·96	2·92	3·07	3·00		2·79	2·84	2·67	
From Jan. 1	..	22·75	27·79	29·36	27·45	26·15	28·11	28·40		27·94	24·15	25·02	

APPENDIX III.

MONTHLY RECORDS.

Station.	Jan.	Feb.	Mar.	Apr.	May	Jun.	July	Aug.	Sep.	Oct.	Nov	Dec.	Year.
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
Cat. Valley..	2·61†	0·15	2·79	0·71	3·02	2·45	3·99	5·22	0·94	6·90	3·80	4·14	36·72
Knockholt..	3·40	0·04	3·05	1·10	3·22	2·63	3·35	5·32	1·25	6·35	3·28	3·12	36·11
Sutton	1·78	0·05	2·34	0·70	3·20	1·60	2·91	4·38	0·98	4·94	2·59	3·17	28·64
Croydon ..	1·89	0·03	2·95	0·63	2·82	1·13	3·84	3·90	0·69	5·75	2·51	2·56	28·70
Forest Hill..	1·97	0·10	2·13	0·64	3·07	1·11	4·20	3·65	1·21	5·58	2·09	2·80	28·55
Woolwich ..	1·66	0·06	2.23	0·82	2·70	1·60	2·83	3·29	0·62	4·92	2·65	1·94	25·32

† Estimated.

APPENDIX IV.

Falls of 1·0 in. and upwards in 24 hours.

July 7th.

Purley (Reedham), 1·04 in.; Addington (Pumping Station), 1·17 in.

July 27th.

Addington (Park Farm), 1·02 in.; West Wickham, 1·11 in.; Keston (Tower Fields), 1·03 in.

July 31st.

Kenley, 1·14 in.; Purley (Reedham), 1·06 in.; Purley (Tudor Cottages), 1·25 in.

August 3rd.

Purley (Tudor Cottages), 1·04 in.; Ashtead, 1·20 in.

August 20th.

Dorking, 1·95 in.; Reigate Hill, 1·86 in.; Caterham, 1·45 in.; Caterham Valley, 1·46 in.; Marden Park, 1·32 in.; Kenley, 1·17 in.; Purley (Tudor Cottages), 1·15 in.; Banstead, 1·29 in.; Ashtead, 1·40 in.; Sutton, 1·01 in.; Carshalton, 1·07 in.; Wallington, 1·03 in.; Beddington, 1·12 in.; Waddon, 1·03 in.; Croydon (Oakfield Road), 1·27 in.; Croydon (Limes Road), 1·19 in.; Croydon (Whitgift), 1·14 in.; Addiscombe (Havelock Road), 1·06 in.; Addiscombe (Outram Road), 1·03 in.; West Wickham, 1·23 in.; Keston (Heathfield), 1·03 in.; Orpington, 1·10 in.; Farningham Hill, 1·25 in.; South Norwood (Selhurst

Road), 1·20 in.; Wimbledon (Sewerage Works), 1·32 in.; Wimbledon (Mt. Ararat), 1·42 in.; Raynes Park, 1·38 in.; Esher, 1·06 in.; Surbiton, 1·19 in.; Kingston, 1·37 in.; Richmond, 1·17 in.; Kew, 1·16 in.; Brixton, 1·38 in.; West Norwood, 1·19 in.; Sydenham, 1·19 in.; Forest Hill (Dartmouth Road), 1·11 in.; Forest Hill (The Nurseries), 1·03 in.

August 21st.

Forest Hill (The Nurseries), 1·03 in.

November 10th.

Dorking, 1·07 in.; Caterham, 1·10 in.; Kenley, 1·05 in.; Purley (Tudor Cottages), 1·06 in.; Ashtead, 1·06 in.; Sutton, 1·03 in.; Carshalton, 1·15 in.; Wallington, 1·09 in.; Beddington, 1·15 in.; Croydon (Limes Road), 1·10 in.; Keston (Bradfield), 1·26 in.; South Norwood (Selhurst Road), 1·03 in.

December 1st.

Dorking, 1·10 in.; Caterham, 1·00 in.; Kenley, 1·20 in.; Purley (Reedham), 1·03 in.; Purley (Tudor Cottages), 1·13 in.; Banstead, 1·19 in.

APPENDIX V.

January.

The long frost which began on November 25th, 1890, and continued through December, 1890, did not finally come to an end until the 23rd of this month, being certainly the greatest and longest frost for over 100 years. Immense damage was done to evergreens and all vegetable produce. The mean temperature at Beddington was 32·4°. The month at Kew was one of the brightest Januarys on record, 74 hours of bright sunshine, a percentage of 28 per cent., twice the average, having been registered. The rainfall was slightly above the average.

February.

The extreme dryness of this month will long be remarkable. In many places there was no measurable quantity of rain, and at Kew, though the total was ·09 in., yet out of this only ·01 was actual rainfall, the rest being concentrated dew or fog. The mean temperature of the month was rather low, being at Beddington 37·2°. and at Wallington 39·3°.

March.

This was a cold and rather wet month, and towards the end vegetation was considered to be at least 16 days behindhand. The great snowstorm of the 9th and 10th will long be remembered, covering as it did the country round here to the depth of 10 in., and to unprecedented depths in the west. The rainfall at Kew was slightly below the average of the past 30 years.

April.

A very cold dreary month, with very small rainfall and a great prevalence of east and north-east winds. At Beddington the low daily maxima were remarkable, there being only 3 days with a maximum of over 60·0°. No rain, or very little indeed, fell in the district after the 12th. The almond was in flower on the 17th, about 3 weeks or a month late; the yellow butterfly was not seen till the last week, nor the cuckoo heard before the 28th; and even at the close of the month hardly any leaves except of gooseberry and currant bushes were out.

May.

The first 14 days were spring-like, with no ground frosts and some refreshing showers; but after this came a change, and snow fell at Kew on the 16th and 17th, and there was a very severe hailstorm at Beddington on the 24th. The rainfall at Kew was ·65 in. above the May average, and at Wallington ·69 in. above the May average for 1886 to 1890. At Kew there were during the month 162 hours of bright sunshine, which was 5 per cent. below the average of the past 14 years. There seemed to be no insect-blight in the Keston district.

June.

A comparatively warm month, and the dryest June since 1887. After the 16th, with the exception of the 23rd, the maximum thermometer in the shade was well above 70·0°. Vegetation, which was backward in the early part of the month, recovered rapidly towards the close. The rainfall at Wallington was slightly below the June average of the 5 years 1886–90. Sunshine was fairly plentiful, and was so hot on the 28th at Beddington as to raise the black bulb in vacuo to 141·0°.

July.

A cold, wet, sunless month, very similar to July, 1890. The hay crop was got in in fair condition, but was about one month late, and strawberries lasted throughout the month, and were a heavy crop. With respect to mean temperature, it was about

60·5°, practically the same as June, instead of being about 2·5° warmer. On the 31st, at Waddon New Road, Croydon, ·29 in. fell in five minutes, between 1.55 and 2 p.m., being at the rate of 3·48 in. per hour.

August.

The weather was practically the same as that of July, being very wet, cold, and sunless, with strong winds during the last 10 days. The rainfall was the heaviest August fall at Kew since 1881, and was 1·9 in. above the past 30 years mean. At Beddington and Wallington it was the heaviest August rainfall since the observations were commenced. The highest maximum in the shade occurred on the 14th, and was at Kew 73·6°, at Beddington 75·0°, and at Wallington 74·6°.

September.

The month was fairly dry and fine, a great contrast to the two previous months, and, beginning with the 8th, there was a week of really hot weather, during which the maximum in the shade for the year was reached. The rainfall was very small, the average for September at Greenwich being 2·41 in., an amount which has not been reached since 1885. The harvest, though in places rather poor, was on the whole got in in a better condition than was at first anticipated.

October.

An exceedingly wet, stormy, and wild month, with no frost until the 31st. The mean temperature 50·5°, at Beddington, was higher than that of any October since 1886. The rainfall was exceedingly heavy. At Keston (Tower Fields) it was the wettest month since the commencement of the observations, and likewise at Beddington, the next wettest October being in 1882. At Kew it was the wettest October since 1880, when 5·94 in. fell, and, with this exception, it was the largest October total since 1865. At Kew, although so much rain fell, yet the amount of bright sunshine was 4 per cent. above the average, 110 hours being recorded, which gives a mean percentage of 33.

November.

The opening week was dry and cold, with easterly, but on the 9th there was a return of stormy wet weather and S.W. winds. A heavy gale, extending over a wide area and doing great damage, occurred on the 11th, and the barometer went down to a lower point, 28·31 in. at 11.30 a.m., than any touched since Dec. 8th, 1886. At Wallington the barometer fell from 30·636 in. reduced, &c., on the 5th to 28·522 in. reduced, &c., on the 11th, a fall of over 2 in. in six days. During the week,

from the 9th to the 16th, at most places in the district, more than $2\frac{1}{2}$ in. of rain fell. During the last week the air was colder, with frosts at night.

December.

The year ends up with an extraordinary month, one which will chiefly be remembered in the district as being without snow, although snow had fallen heavily all round us. It may be divided into two distinct portions, the weather in the first half being cyclonic, with heavy rain and warm winds; but the latter half was dry, very cold, with exceedingly dense and continuous fogs, and abnormally heavy rime on trees, buildings, &c. The frost gave way on Christmas Day, and the month ended up as it began. But for this cold spell it would have been at Beddington one of the warmest Decembers for many years, and even as it is, it is the warmest since 1884, the mean temperature being 39·5°. It is remarkable that at Beddington the mean maximum of December, 1890, was only 0·3° higher than the mean minimum of the present one; but the variation of the daily mean was far more than in 1890, the difference between the warmest and coldest days (4th and 22nd) being 33·5° as against 21·0° in December, 1890.

☛ *Members are reminded that the paging in the 'Transactions,' articles* 60 *to* 63 *inclusive, was wrong: instead of* 1 *to* 21, *it should be* 111 *to* 131. *Members should correct this before binding, as in the Index the corrected paging will be referred to.*

INDEX.

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INDEX.

CONTENTS.

PROCEEDINGS.

TRANSACTIONS.

Croydon Microscopical and Natural History Club.

OFFICERS FOR 1892.

President.—EDWARD LOVETT.

Vice-Presidents.—JOHN BERNEY, F.R.M.S.; PHILIP CROWLEY, F.L.S., F.Z.S., &c.; HENRY S. EATON, M.A., F.R. Met. Soc.; HENRY T. MENNELL, F.L.S.; HENRY G. THOMPSON, M.D.

Treasurer.—EDWARD B. STURGE.

Committee.—T. D. ALDOUS, F.R.M.S.; J. WEIR BROWN; A. B. CARPENTER, B.A., M.R.C.S.; C. H. GOODMAN; H. D. GOWER; W. MURTON HOLMES; K. McKEAN, F.L.S.; W. LOW SARJEANT; ERNEST STRAKER.

Librarian.—F. C. BAYARD.

Hon. Secretary.—WALTER BUDGEN.

PROCEEDINGS & TRANSACTIONS

OF THE

CROYDON

MICROSCOPICAL & NATURAL HISTORY

CLUB.

FEBRUARY 10, 1892, TO JANUARY 11, 1893.

CROYDON:

PRINTED FOR THE CLUB, BY WEST, NEWMAN & CO., HATTON GARDEN, LONDON.

—

1893.

PROCEEDINGS

OF

THE CROYDON MICROSCOPICAL AND NATURAL HISTORY CLUB.

1892—93.

Twenty-third Annual Meeting.

Held at the Public Hall, Croydon, January 11th, 1893.

EDWARD LOVETT, President, in the chair.

THE Balance-sheet of the accounts for 1892 (p. xix) was taken as read and passed.

It was proposed by the President, seconded by Mr. Mennell, and carried unanimously, that Dr. H. Franklin Parsons, M.D., F.G.S., be elected President for the ensuing year.

It was proposed by Mr. McKean, seconded by Mr. Turner, and carried, that Mr. Thos. D. Aldous be elected Hon. Secretary to the Club in the place of Mr. Budgen resigned, to whom a hearty vote of thanks was accorded for his services to the Club during his tenure of office.

On the proposition of Mr. Crowley, seconded by Mr. Low Sarjeant, Mr. Sturge was unanimously re-elected Treasurer, and Mr. F. C. Bayard was re-elected Librarian.

No other nominations having been received, Messrs. Cushing, Lanfear, and H. C. Collyer were elected to serve on the Committee in place of Dr. A. B. Carpenter and Mr. Ernest Straker, who retire in accordance with the rules, and of Mr. Aldous, appointed Secretary.

In accordance with the foregoing resolutions, the following is the list of officers for the year 1893:—

President.—H. Franklin Parsons, M.D., F.G.S.

Vice-Presidents.—John Berney, F.R.M.S.; Philip Crowley, F.Z.S., F.L.S.; Henry S. Eaton, M.A., F.R.Met.Soc.; Henry T. Mennell, F.L.S.; Henry G. Thompson, M.D., J.P., &c.; Edward Lovett.

Treasurer.—E. B. Sturge.

Hon. Secretary.—Thos. D. Aldous, F.R.M.S.

Librarian.—F. C. Bayard, LL.M., F.R.Met.Soc.

Committee.—J. Weir Brown; H. C. Collyer; Thos. Cushing, F.R.A.S.; C. H. Goodman; H. D. Gower; W. Murton Holmes; K. McKean, F.L.S.; C. Lanfear; W. Low Sarjeant.

The President then delivered his Address, at the conclusion of which a cordial vote of thanks was accorded to him for all that he had done for the Club, and for the able manner in which he had occupied the chair during the past three years.

The President's Address.

Gentlemen,

In presenting to you my third and last Presidential Address, I do so with mingled feelings of satisfaction and gratitude: satisfaction that the Club is, in every way, in a flourishing and sound condition, and gratitude to those many friends who, by their wise counsel and greater experience, have assisted me so ably in carrying out the duties devolving upon this chair to which you did me the great honour of electing me three years ago. As I have stated, our position to-day is perhaps even stronger and more satisfactory than it has been for years past. Our roll of members has certainly slightly decreased, for we have lost 36 against 27 elected during the year, our number at the present moment being two hundred and eighty-eight. This apparent falling-off is due, however, chiefly to the fact that several members have been struck off the roll in consequence of a slight forgetfulness or disinclination on their part to pay their arrears of subscriptions, in spite of repeated applications and notices. We have, however, lost six members by death, including Dr. Carpenter, whose loss we all deplore; as well as Sir Thomas Edridge, and Mr. H. Lane, of Addiscombe House.

The Balance-sheet which is in your hands may be considered very satisfactory. We commenced the year with a bank balance of £9 19s. 6d., and no liabilities, and we close it with one of £48 15s. 10d., and no liabilities, a clear gain of nearly £40. This very pleasant state of things is due to several causes, to the care and diligence of our Hon. Treasurer, and to the economy and good management of our Hon. Secretary, and to the

generous donations to meet the expenditure in connection with our Rainfall statistics. The subscriptions have been got in very satisfactorily on the one hand, and there is a marked reduction under the head of printing, stationery, and postages. Then again as to the Soirée, the cost looks rather larger, but in 1891 the orchestra was not paid for by the Club, whereas in 1892 it was. On the other hand, however, our sale of tickets rose to the unusual figure of £26 12s. 6d., as against £19 7s. 10d. for 1891.

Our Special Fund balance is £24 13s. 9d., available for fittings, appliances, and such like necessaries in connection with our Society; so that with petty cash in hand, we now possess a year's balance of £76 5s. 1d., and an invested capital of £210 11s. 8d. in Consols, which is, I venture to think, remarkably good for a suburban scientific society of twenty-three years' standing.

We now turn to the work done by the Club during the past year. Our Sub-Sections continue their work in a satisfactory manner. The Geological Section has taken charge of a whole-day excursion, and an evening ramble, both of which will be referred to later on, but as no members of this Sub-Committee have sent in any notes to the Hon. Sec., there has probably been nothing done during the year in breaking fresh ground in our neighbourhood.

The Botanical Section has had charge of two excursions which are described later on, and also arranged an extensive exhibit of plants at our Soirée, to which further reference is made in my report of that function.

The Meteorological Section reports as follows:—

Report of the Meteorological Sub-Committee for 1892.

The Meteorological Sub-Committee has continued its work under the supervision of its Honorary Secretary, Mr. Bayard. The daily rainfall of 50 stations in the Club district has been tabulated every month, examined, and corrected, and the results printed and issued to the observers and all members of the Club interested in the question either before, or within a very few days after, the end of the month succeeding that to which the statistics refer. Further particulars will be found in the scientific report of the Sub-Committee which will be presented at the meeting next month.

The Committee having felt that the finances of the Club could no longer bear the strain of the Sub-Committee's expenditure, six gentlemen interested in the matter subscribed the sum of £22 12s. towards the cost, the Club providing the balance. The gentlemen subscribing considered the statistics of such value to science, and also to the well-being of the Club, that the subscription has been a matter of pleasure to them.—Francis Campbell Bayard, *Hon. Sec.*

In the Microscopical Section a practical demonstration was given early in the year on drawing from the microscope by means of the camera lucida, &c., by Mr. T. D. Aldous, which

was well attended. This demonstration seems to have been highly appreciated by those present, and it is hoped during the present year that several similar meetings may be arranged. It is the feeling of the Sub-Committee that something of the kind is necessary to awaken an interest in microscopic studies amongst the younger members of the Club. The microscope has of late years passed beyond the stage of being a mere scientific toy, and the field of research still unexplored is enormous.

Report of the Photographic Sub-Committee for 1892.

In handing you the Report of the Sub-Committee of the Photographic Section of the Club, I am pleased to say that the Section has passed through a very successful season. Eight excursions were made during the summer; two being General and Photographic, and six Photographic. Technical and Conversational Meetings have been held once a month, as well as the monthly lantern nights, and trial nights for members' slides.

At the Soirée, the Sectional Exhibit was small (small from the number of members exhibiting), but otherwise good; but I am sorry at the same time to say that, considering the large number of members that the Section consists of, it was not such a large exhibit as might have been expected.

The General Committee have gone to great expense and trouble in fitting up the room next to the Club room as a dark room for the Photographic Section; water, gas, and a developing table have been supplied with dishes, measures, &c., and, in fact, everything requisite and necessary for the carrying on of Photographic work. And it is hoped by the Committee that the members will endeavour to use the same in a way that will at least let those who have taken so much trouble and time for the Section see that their efforts to please and further the interest of the Section have not been made in vain.—Harry D. Gower.

The Zoological Section has an interesting record so far as Entomology is concerned. The season of 1892 was a remarkable one in respect to insect life. For some years butterflies have been getting quite scarce, but this year they were abundant. In our gardens were to be seen the blues and the small coppers as of yore, whilst the *Vanessas*—*urticæ*, *atalanta*, and *io*—were really quite common, as also were several of the *Pieridæ*. Perhaps the event of the year was the profusion of *Colias edusa*, with some *C. hyale*, and a few of the interesting variety *C. helice*. Mr. Berney records many captures of them at Russell Hill, where also, and elsewhere, Mr. Harry Lee took a number. Mr. Mennell also records early hybernating specimens in June at Park Hill, and he says he saw later specimens almost wherever he travelled, Essex, Somerset, &c. It would be curious to know the cause of these intermittent occurrences, for in some years it is a very scarce insect.

There are, I think, three chief causes which influence the life of Lepidoptera, and produce a scarcity or an abundance of a species, *viz.*, a favourable period for fertilization, *i. e.*, a warm sunny time as opposed to a cloudy, chilly and wet period; for I am inclined to think that this period of fertilization is just after emergence, and not during the whole life of the insect. Then again, there is the health of the larvæ, and its food-plant; cold wet weather being as detrimental to growth as dry chilling winds, whilst warm and slightly moist seasons are the best. Lastly we come to the question of its enemy the Ichneumon Fly, of which there are many affecting many different species of Lepidoptera. If all these causes were favourable to, say, *Colias edusa*, we can understand the abundance we have this year seen of the insect, whereas if the three causes worked together against it, we can quite see how rare it might suddenly become, even to being in some localities exterminated for the time.

List of Lepidoptera taken at The Close, Chatsworth Road, except as otherwise stated, in the summer of 1892, by Mr. John Berney.—*Polyommatus phlœas*, 2. *Colias edusa*, "taken at Russell Hill," 10. H. Lee took a large number, principally *C. edusa*, a few *C. hyale*, and a few *C. helice*. Noctuæ:—*Plusia festucæ*, 20; *P. iota*, 1. *Dipterygia pinastri*, 6. *Gonophora derasa*, 5. *Thyatira batis*, 6. *Gramueria trilinia*, 2. *Xanthia citrago*, 1. *Leucania conigera*, 1. *Agrotis lunigera*, 4. *Triphæna subsequa*, 1. Hepalidæ:—*Lupulinus hectus*, 13; *L. humuli*, 11. Geometræ:—*Amphydasis betularia*, 2. Also larvæ of *P. festucæ* and *P. iota* hybernating.

Excursions.—The excursions during the past year have been of great interest, and have moreover been remarkably well attended. A new departure was the arrangement of short evening rambles, which were so much appreciated that it is to be hoped they will be continued. The following is an account of the rambles of the year:—

On May 21st, an excursion to East Grinstead and Lingfield was conducted by Mr. E. Straker. The party, twelve in number, proceeded by train direct to East Grinstead. A visit was first paid to Sackville College, an ancient foundation for the relief of decayed townsfolk and tenants. The rooms of the warden and the chapel were kindly shown, the former containing some quaint furniture, &c. Several photographs were taken of the College, and the walk was then resumed to Wire Mill Pond and Lingfield. About the pond *Cnicus pratensis*, *Serratula tinctoria*, *Valeriana dioica*, *Carex vesicaria*, *C. curta*, a *Nitella*, and a species of *Utricularia* (but in too young a state for determination), were observed.

On June 6th (under the direction of Mr. E. B. Sturge) to Cowden. A party of about twenty-four members and friends met about 11.30 at Cowden Station and proceeded to the village,

where some fine timbered houses were seen. The Rector, the Rev. Dr. Burton, was fortunately met with, who kindly showed the party over the old church, which contained many fine pieces of work. The spire and belfry were practically supported by four oak trees roughly squared. The five bells were of very sweet tone. The pulpit is of fine carved oak, and has an ancient iron bracket carrying an hour sand-glass, about which there is a curious legend. On the floor of the Church is an iron slab said to have been cast at the iron works which formerly existed at Furnace Mill.

The party then proceeded to Holtye Common and the Furnace Ponds, at which place many objects of Natural History were collected. Of butterflies, the orange-tip *Cardamines* was common, as also were skippers of the genus *Thanaos;* some hybernating *Colias edusa* were seen, as well as several fritillaries. Of plants, many orchids were found, as also numbers of ferns,—*Lastræa Filix-mas, L. dilatata,* and *Blechnum;* also examples of the stag-horn moss, *Lycopodium.* The ponds abounded with microscopic life, and a few very fine shells of *Anodon cygnea* were obtained. The party then walked to East Grinstead, passing on the road a "gamekeeper's museum," where hung several weasles, kestrels, and jays. The day was beautifully fine, though rain had fallen previously.

June 25th. Mr. Mennell, who conducted this excursion, sends me the following:—A party of about ten met at East Croydon Station, and went by train to Marden Park, where they disembarked and took the road to Woldingham. About half a mile up the road the ground on either side is open to the road, and with a full south exposure is about as sunny a spot as can well be imagined. The plant *par excellence* of this tract is *Fragaria vesca,* better known as the wild strawberry, and it here covers some 800 acres with a profusion not often equalled in the Alps, and rarely, if ever, in this country. A year or two back the bee orchis abounded on these slopes, but this year only a stray plant or two were seen. This seems to be the habit of the family, abundant one year, scarcely to be found the next. It would be interesting to observe carefully whether this is due to the season and the weather, or to the plant needing a rest after flowering. That it was not merely the season seems proved by what followed later. A fine plant or two of the larger butterfly orchis, *Habenaria bifolia,* was gathered; but nothing else beyond the ordinary plants of the chalk.

The party then walked across the fields to the opening of the Hallelu Valley, the happy resort in summer of numbers of children's treats and beanfeasters; these, however, have not interfered with the flowers of the valley, as fortunately neither

children nor beanfeasters stray far from the meadows round their head-quarters. By the side of the road Mr. Budgen espied a fine goat moth just emerged from its chrysalis which lay near by. There was no appearance of wood near, but probably the rotten stump would have been found had the sandy bank been probed. The large helleborine, *Cephalanthera grandiflora*, a local chalk orchid, was found in the woods on the slopes of the valley, and in the meadow below the wood we came unexpectedly upon a very remarkable patch of the bee orchis in full flower; there must have been little short of a hundred blooms within the space of a few yards. This seems to show that the season was not at fault, or the cause of its absence elsewhere as mentioned above. The viper's bugloss, *Echium vulgare*, was remarkably fine on the dry sunny slopes; near here too is the classical locality of the rare *Lathyrus hirsutus*, one of the two or three British plants found only in the county of Surrey. It was in good flower, but is scarce, and should be carefully protected by every Surrey botanist. From the head of the Hallelu Valley, we made for the high road between Warlingham and Worms Heath, and crossing it, took the road to Farley, following bye-paths most of the way; and some little ignorance of the public-houses of the district was exhibited by the nominal leader of the party, so that the promised tea was deferred till later. The walk continued by a pleasant path through the woods leading from Farley Green to Addington Bottom, and in the well-known locality, discovered by the late Mr. John Flower, the other great Surrey rarity, *Teucrium Botrys*, was found in abundance, though not yet in flower. Until this discovery, Box Hill was the only British locality for the plant, and there it is now very rare. A pleasant walk up to the Addington Hills brought the party at last to their long promised tea. The view from the hills was particularly fine and far reaching, and a rather dark wild sky made the scene almost Scotch in its character.

On July 9th, an excursion was made to Ightham, under the guidance of Mr. F. C. Bayard. Mr. Budgen, who was one of the party, reports that of Lepidoptera, he observed or captured *Vanessa urticæ* and *V. atalanta*, also *Cabera pasaria*, *Fidonia piniaria*, and *Ellopia fasciaria*. Dragonflies were plentiful, and *Agrion puella* and *A. minium* were seen, as well as *Libellula depressa*. Of plants, were observed, *Hypericum humifusum*, *Verbascum thapsus*, *Sedum rupestre*, *Epilobium angustifolium*, *Galium palustre*, *&c.*

On July 20th, an evening ramble was made (conducted by Mr. Straker) to Purley Downs and Sanderstead. The party, about fifteen in number, including several ladies, arrived at Sanderstead Station shortly before six, and at once proceeded through Purley Beeches on to Purley Downs, for which Mr. T. Chandler, of Purley Oaks,

had kindly given permission. The storm of the previous night had broken a very large limb from one of the beeches; it was honeycombed with holes containing remains of birds' nests, &c. In a smaller tree, a wood pigeon's nest containing two eggs was discovered, but not disturbed. Among the numerous plants noticed may be mentioned the rampion (*Phyteuma orbiculare*) in great abundance (*Asperula cynanchica*), dropwort, *Viola hirta*, with cleistogamous flowers and fruit, and many other plants characteristic of the chalk down flora. The way was then taken through cornfields to Sanderstead Church, and thence by the footpath to the foot of Croham Hurst and to Croydon; the distance traversed being about seven miles. The members and friends who took part in this ramble agreed that this new departure of the Club was a distinct success, the more leisurely proceedings enabling greater attention to be given to observation and to discussion than on distant and more ambitious excursions.

August 1st. This excursion was under the direction of the Geological Sub-Committee, and was conducted by the President and Hon. Sec. Members and friends to the number of eighteen assembled at Betchworth about 10.20 a.m., and leaving the station, proceeded through the curious old village to a bridge over the river Mole, the pretty scenery near this spot being very much admired. The party then walked towards the range of chalk hills, passing through a brickfield situated on the Atherfield clay, and a sand-pit in the Folkestone beds, till another brickfield was reached, on the gault clay, where the interesting machinery for making bricks by the dry and wet processes was examined, as also were the drying and burning kilns. A visit was then paid to the hearthstone-pits, a series of underground workings penetrating for a considerable distance into the hill. These were explored by several members of the party, who examined with much interest the headings and the shoring up of the roof of the passages, the fungoid growth on the timbers used being of a most remarkable appearance. The ascent of the escarpment was then continued until a large chalk-pit was reached, where a magnificent face of chalk was exposed, and a few fossils were found. After a further arduous climb, the summit of the hill was reached, when the party rested to enjoy the splendid view, and hear some notes relating to the locality by Mr. Budgen. Walton Heath was then crossed, and some loam-pits containing small fractured flints of neolithic age were examined. Reigate was reached about 4 p.m., where the party was received at Highfield, the residence of Mr. Budgen, Sen., who hospitably provided tea on the lawn of his house. The members of the Club arrived at Croydon at about half-past six o'clock, after a most pleasant day.

Notes on the district visited:—In early times the whole area of

the weald was dense forest land tenanted by wolves, wild boar, and other animals, which gave much trouble to the primitive inhabitants of the locality. A main track-way led along the ridge of hills, its exposed position being selected in order to secure travellers against surprise by robbers or wild beasts. Along the valley ran the little river Mole or Y-melyn. On Walton Heath the invading Romans encamped, and at Bletchingly a Roman villa has been traced; but traces of them beyond this in the immediate neighbourhood are scarce. At the time of the Saxon invasion, the Weald forest is said to have been 120 miles long, and 30 miles wide, and is often alluded to as an impenetrable forest, and a place that evidently inspired terror, as it was the resort of robbers and outlaws; the Anglo-Saxon word for robber being "wealdgenge," a farer or dweller in the weald. The Pilgrim's Way, which on the gravel and upper greensand is bordered by yew trees, is bordered by ash to the east of Reigate; it may, and probably was, used by pilgrims, but it is more than probable that they merely used a good track which was already there, and which dates back to a very much earlier period than that of the pilgrims.

August 24th (evening geological ramble). A small party of five members assembled at 6 p.m. on the East Croydon railway bridge, and walked thence up Park Hill Rise to the edge of the new railway cutting, where the position of the Oldhaven, Woolwich, and Reading beds was discussed, and where several blocks of pebbly rocks were still to be seen, and the fossils they yielded were examined. The large chalk-pit at the Coombe Lane end of Park Hill Road was next visited, and the junction with the overlying beds traced. The party were indebted to Dr. Franklin Parsons, who was present, for much valuable information on the subject.

On Sept. 3rd an excursion was made to the Gardens of the Zoological Society, under the direction of Mr. Crowley. The day was very fine, and nine members put in an appearance. The diving birds were visited, and were fed to illustrate their mode of taking their prey under water. The reptile house was next visited, and after that an inspection was made of the elephant and hippopotamus house, where was seen the young hippopotamus born in the Antwerp Gardens. In the parrot house, the curious ka-ka, or flesh-eating parrot, attracted much attention. In the insect house the tarantula spiders were excited from their hiding-place by the keeper, and gave much interest. These large spiders were stated to be fed on cockroaches and young mice. The scorpion too was induced to show itself, and in an adjoining case was seen a large living bulimus from Trinidad. A land crab was also seen, which strongly resembled its marine relatives, even in the readiness with which it parted with its

limbs; this particular specimen having lost nearly all it ever possessed. The electric eel was also the centre of much attention. A number of small fish were thrown into the tank, and appeared to at once feel the terrible effects of the electric shock, for they performed the most violent gyrations immediately, and those which escaped the maw of the eel seemed utterly paralyzed and unable to move afterwards.

During the year eleven papers have been read at the ordinary meetings of the Club, besides one lecture in the large Public Hall, to which latter members and friends were invited. The following is a list of the subjects of these papers, *viz.*:—

February 10*th*.—The "Report of the Meteorological Sub-Committee on the Rainfall of the Croydon district for the year 1891" was presented by Mr. F. C. Bayard. The tabulated matter, which shows great care in its arrangement, appears in our last Report (Trans., Art. 101). A paper was read by Mr. C. Lees Curtis on "Nelson's new Projection Microscope." The microscope projection apparatus is made on the model suggested by Mr. E. M. Nelson, and consists of an oxyhydrogen lantern with a $4\frac{1}{2}$-inch double condenser, a water trough condenser having a plano-convex lens at one end, and a concave at the other, and so constructed that all heat rays are stopped. The light passes through the condensers and trough, emerging from the concave in parallel rays. To the end of the water trough is attached the microscope, consisting of substage with sliding focusing arrangement, having a hinged opening through which the different substage apparatus can be placed in position, the top of this opening is shut with a spring, a large stage with a clip to hold the object and different sized diaphragms, and a sliding body with micrometer screw fine adjustment complete the apparatus. The instrument shown was provided with an oxyhydrogen mixer jet having rackwork vertical adjustment, and quadrant plate lateral movement; these adjustments allow the light to be easily and accurately centred to the optic axis. Different substage condensers are required to suit each objective used, and arrangements are made for "dark ground" and polariscope effects; these latter, however, entail considerable loss of light.

March 9*th*.—"The Early History of the Microscope," by Mr. T. D. Aldous, F.R.M.S. In this paper, which appears in our 'Transactions' (Trans., Art. 102), Mr. Aldous dealt very fully with the early history and development of the instrument; describing those by Hooke, 1665; Divini, 1672; Bonnani, 1698; Marshall, 1702; Gundelius, 1702; Culpeper, 1740; Cuff, 1744; Adams, 1771, and others. And considering the perfection to which the instrument had now attained, it was certainly mar-

vellous to think what the early naturalists had achieved with the means at their disposal. Mr. Aldous' paper was illustrated by a number of diagrams of early forms of the microscope, as well as by some old and valuable examples from his own collection.

April 13*th*.—"Notes on a Ten Weeks' Trip to the United States and Canada," by Mr. E. B. Sturge. In this lecture, which was largely attended, and which was illustrated by a fine series of slides shown by the optical lantern, Mr. Sturge gave an interesting account of the various American and Canadian towns he had visited, and of Pike's Peak, which he had ascended. The heat, he said, was in some places very great, the thermometer standing as high as 101° Fahr. A number of slides showed some of the leading features of New York, which were graphically described, as also were the Niagara Falls, and the wonderful Hoosac Tunnel. The magnificently wild scenery of the Rocky Mountains was next referred to, and many beautiful slides were shown; some of these being photographs of some of the gigantic forest trees of that locality. At Pike's Peak, which is 14,115 feet above sea-level, the ascent can be made by the cog-wheel railway, recently opened. On the summit is a signal house belonging to the United States Weather Bureau. The journey to San Francisco was then described, and Mr. Sturge said that the ferry boat which crosses the Straits of Carquinez is considered to be the largest in use, being capable of taking twenty-eight Pullman cars at one journey. Puget Sound was stated to be a remarkably fine expanse of water, with the banks so beautifully wooded that the forest-growth extends right down to the water's edge. Near Banff and Winnipeg, Mr. Sturge saw some magnificent scenery. At the latter place is situated the head-quarters of the Hudson's Bay Company, with large warehouses and stores. The distance of this town from Vancouver is 1,482 miles. The lecturer said that he had not very great facilities for noting the Natural History features of the country through which he passed, but he had seen during his visit whales, prairie-dogs, Californian grey squirrels, chipmunks, foxes, cow-birds or starlings, prairie fowl, jays, grouse, humming-birds, and last, but not least, mosquitoes. The lecture, which much interested the audience, was illustrated by a number of objects of general use collected from the various tribes of North American Indians, and which were exhibited by the President.

May 11*th*.—"Abnormal forms and variations in the Animal Kingdom," by the President. In this paper reference was made to the various ways in which abnormalities occur, such as albinism, melanism, and even monstrosities. But the paper dealt with such comparatively normal variations as might result from any change in the surrounding conditions, either geological, climatological, &c. And cases were cited in which such variations

did occur, and might even be perpetuated by a continuity of the altered conditions. Such variation being the result of a struggle on the part of the organism to put itself in complete correspondence or accord with its environment (Trans., Art. 103).

Sept. 14*th*.—"On the Composition of the Hearthstone obtained from Betchworth, microscopically considered," by Mr. Murton Holmes. The stone which had been collected on the Bank holiday excursion, August 1st, was when first quarried of a dull greenish colour, but dries of a greyish tint, and is rather harder. The microscopic organisms discovered are stated in the paper (Trans., Art. 104). "Observations on the Emergence of the Crane Fly, *Tipula oleracea*," by Mr. C. H. Goodman. In which position and movements of the pupa, and the method in which the imago frees itself, were carefully described (Trans., Art. 105). "On a Series of Fire-making appliances from Rajpootana, India," by the President. This paper gave a description of two classes of appliances, namely, the friction and the percussion methods. The former were represented by the usual twirl stick and hearth, and was found in use amongst the Bhiels, a native aboriginal tribe, whilst the latter was illustrated by steels and pieces of chalcedony, agate, and other silicate rocks. These were obtained in Hindoo country villages (Trans., Art. 106). Besides these papers, Dr. Franklin Parsons gave an interesting account of fossil ostræas. Mr. Kenneth McKean described the occurrence of a variety of *Planorbis albus*. Mr. W. Low Sarjeant gave particulars of a fine series of land and fresh water shells shown by him. Mr. Berney exhibited and described a collection of Lepidoptera made by him in the New Forest, and Mr. Crowley showed a series of butterflies of the genus *Colias* from the palæ-arctic region.

Oct. 12*th*.—"On the Mouths of Insects," by Mr. C. H. Goodman. In which the organs and general structure of the various forms of mouth were described, showing how, although the same general plan obtained in nearly all cases, a very decided difference occurred owing to the development of some particular part, or the devolution through absence of requirement of another part. The paper was illustrated by a large number of lantern slides of micro-photographs and diagrams shown by the optical lantern (Trans., Art. 107).

Nov. 9*th*.—By Mr. H. M. Wallis (President of the Reading Literary and Scientific Society) on "The Descent of the Bird." The lecturer began his discourse by a defence of the theory of evolution, and said that at first sight there did not appear to be much connection between a tom-tit and an alligator, yet he would trace the bird structure back to that of the great Saurians of the trias and other geological epochs, thus giving to birds a reptilian ancestor. After describing the earlier remains of fossil

reptiles, he said that in the trias the reptilia became long-legged, and their eyes were modified, as in the case of the Dinosaurians, reptiles so large that some of them probably weighed as much as thirty tons. Again, in the Iguanodon the armour-like covering probably gave way to a hairy skin. The bones of the Dinosaurians were tubular, and in this respect approached the bird structure. One of the great difficulties of tracing the development was the scarcity of the fossil remains of birds, but in the Archæopteryx of Solenhofen we have a true fossil bird, about the size of a magpie, but having a long vertebral tail. Then we have the birds of the Kansas chalk. A strong mark of resemblance exists in the eye, which in birds is set in a circle of locking bones ; this is found also in Iguanodon. Again, the condyle, or process at the base of the skull, is single in reptiles and birds, whilst it is double in all mammals. The structure of the vertebral bones, though varying somewhat, show again a close relative correspondence between reptilia and birds, as also does the consolidation of the pelvic bones. In *Hesperornis* the pelvis assumes the bird form. The lecturer then described the *Dinornis*, and other gigantic struthian birds, and said that though there were no living wingless birds in Madagascar, the bones of *Epiornis maximus* were found there. The lecture concluded with a description of the structure of our recent birds, showing the greater or less development of certain parts in conformity to the conditions under which each species existed. At the conclusion of this admirable paper observations were made by the President and Mr. Mennell, who drew attention to the discovery by Mr. Klaassen, a member of the Club, of the bones of a gigantic bird in the strata of Park Hill.

Dec. 14*th.*—In the unavoidable absence through rather sudden illness of Mr. J. Charters White, who was to have read a paper, Mr. H. Tuke Mennell kindly took the evening, and gave a most interesting and graphic account of a visit to Norway. After referring to the geology, botany, ornithology, &c., of the country, Mr. Mennell described and discussed the origin of the remarkable fjords, which everywhere break up the coastline, and Dr. Hinde, at the conclusion of the paper, made some additional remarks on the same subject. These notes on Norway will appear in our 'Transactions' (Trans., Art. 108). The President then made a report on his microscopic examination of dust collected on the glass of cases exhibited at the Soirée. It consisted chiefly of such materials as might be expected to occur in large crowded assemblies under such circumstances. There were traced fibres of wood, cotton, silk, wool, jute, particles of iron, silica and leather, small barbs from feathers, human hair, and hair of chinchilla, besides one or two uncertain atoms of material. Mr. Philip Crowley also exhibited and described a nest and an egg of

bird of paradise (*Paradisia raggiana*) from New Guinea, an unique specimen, being the first brought to Europe.

On Wednesday evening, 27th April, 1892, a lecture was delivered by Dr. R. Bowdler Sharpe, F.L.S., &c., in the Large Public Hall, entitled "Curiosities of Bird Life." The lecture, which was illustrated by eighty coloured pictures specially designed by the celebrated Natural History artist, Mr. J. G. Keulemans, and shown by the oxyhydrogen lantern, treated of many points of interest connected with birds. Dealing first with merely curious birds, such as the Bohemian waxwing, &c., the lecturer went on to describe the similarity that often existed between birds of quite different genera, or even families, such adaptiveness being in some way for the benefit of the altered species. Dr. Sharpe also referred to the protection that many species derive from their resemblance to other and quite different objects, and instanced a most amusing case of a bird whose marking made it almost indistinguishable among reeds, dodging its pursuer. Birds which had strong tastes for artificial decoration were then referred to, and the bower birds were especially described. The lecturer concluded with some most interesting observations on the swallow, giving an account of their migratory habits, and showing a series of pictures of towns passed over by swallows in their autumn migration to the sunny south. The lecture, which was arranged by the kindness of Mr. Crowley, was greatly enjoyed by a large number of members and their friends.

The Twenty-third Annual Soirée of the Club was held at the Public Hall on Nov. 23rd, and was in every way one of the most successful on record. In the Microscopical Section 92 instruments were exhibited, and the objects shown by them were far above the average in point of interest. Some early forms of the microscope were also displayed by Mr. Aldous. Mr. Crowley exhibited yet another section of his magnificent collection of bird and insect life. Amongst the botanical exhibits were a number of dried plants shown by Mr. H. T. Mennell, which had been treated with dry salicylic acid. The acid, which is in the form of a white powder, is dusted over the flowers when they are put in the press, and the process is repeated when the papers are changed. The colours of flowers are well preserved by this method, which seems better adapted to their fragile flowers, such as campanulas (bluebells), and the like, than that of immersion in sulphurous acid described last year. For fleshy flowers with more substance, the latter process appears the best. With salicylic acid, some flowers, *e. g.*, the bee orchis, are rendered more vivid in colour than is natural. As is well known the blues

of flowers, like campanulas, are most difficult to preserve by the ordinary method of drying. The action of both sulphurous acid and salicylic acid seems to be to destroy the vitality of the plant at once, and to prevent any fermentation setting up in the juices. It is this fermentation which affects the colours. A very fine series of beautifully preserved and mounted plants were also exhibited by the Messrs. Salmon. The collection of flowers gathered in the open air on the day of the Soirée was in the hands of Dr. Franklin Parsons. The series was a very large one considering the havoc caused in all exposed gardens by an unusually early and severe frost. Mr. Low Sarjeant showed a very carefully arranged collection of British land and fresh water shells; and a Campbell sunshine recorder, and a series of photographs illustrating the progress and results of a tornado, were exhibited by Mr. Bayard. Objects of general interest from Egypt, by Mr. E. B. Sturge. Native weapons, &c., from India, by Mr. C. J. N. Yuill. Other weapons from the Maoris, by Mr. Evan Carpenter. Some interesting original drawings of molluscan odontophores by Prof. Sars were shown by Mr. K. McKean; and several calculating machines, by Mr. W. F. Stanley. Mr. Thorpe, of George Street, lent a number of zoological specimens, trophies, &c.; and Mr. H. C. Collier showed some ethological specimens from Barrows, near Arundel. The President's exhibit was his collection of stalk-eyed crustacea from the British seas, including every known species but two or three. A very good exhibit was made by the Photographic Section, both of prints and transparencies; but a comparatively small number of photographers were represented, considering the large number there are in the Club. The enlargements by Mr. W. Low Sarjeant, Mr. Hirst, and one or two others, were very fine, and a capital series showing the different warm tones to be obtained on bromide paper were shown by Mr. Weir Brown. Two lantern exhibits were given during the evening in the old School of Art Room, and were well patronised. The spacing arrangements were, as usual, in the skilful hands of Mr. Berney, and the decorative plants were again kindly lent by Mr. Crowley. Through the generous co-operation of Messrs. Mennell, Crowley, Berney, Budgen, McKean, with my suggestion to provide the refreshments ourselves, and thus relieve the Club of this important item of expense, the financial result of the Soirée was eminently satisfactory, and the satisfaction given to our visitors more so. Our total Soirée expenses, as will be seen, was only about £36, whilst our sale of tickets rose to the unusually high figure of over £26, thus reducing the net cost to the Club to some £10, an exceedingly gratifying result, and one not often attained.

Our Conversational Meetings have not been much better than

usual, except in one or two instances; but it is hoped that by organising some practical evening for work they will become more useful, and therefore better patronised. The acquisition of another permanent room to be used chiefly for a photographic dark room, but also available as a room for general practical work, cannot but prove of great use and value to the Club, and it is hoped that members will not fail to take advantage of it. Another step in advance is the decision of your Committee to appoint, at a small remuneration, an Assistant Secretary, to relieve the Club's Hon. Sec. of much of the mere routine portion of his duties, and thus enable him to devote more time and care to the general management and direction of the Club. We are also recording to-night a still further advance, in the opening, so to speak, of the nucleus of that museum which it has long been hoped may some day be formed in the town of Croydon under the fostering care of this Club. The fine collection of shells and corals, fossils and minerals formed by the late Dr. Carpenter, one of our former Presidents, and one of the most active supporters of the Club in its past, has been generously presented to us, together with the cases and cabinets containing them, by his family. Through the kindness of the Committee of the Institution, and the great courtesy and anxiety to meet our views of its Hon. Sec., Mr. Harry Berney, these cases of specimens are allowed to be placed in this our meeting-room, where, I trust, the "Carpenter collection" will prove of interest to our numerous members, and be the starting-point from which our long wished for museum may grow. Gentlemen, I think I have done, and it is my fervent wish that you will all help forward the interests of our Club. Its record is a good one, and I am happy in feeling that our past year, although our twenty-third, has been one of prosperity and advance. I feel sure that in the good hands about to take charge of the ship we may look forward to a happy new year.

Members elected, 1892.

January 13th.—Francis Carter, High Street, Carshalton, Surrey. Joseph Hall, Melton Lodge, Havelock Road. Surgeon-Genl. Wm. Pearl, Stuston Lodge, Scole, Norfolk. Chas. E. Salmon, Clevelands, Wray Park, Reigate. Ernest T. Salmon, Clevelands, Wray Park, Reigate. Chas. Thorpe, 22, George Street.

February 10th.—H. E. W. Weaver, 84, Brighton Road.

March 9th.—H. Whitby Philips, M.D., Addiscombe Road. Richard Flint, Woodstock House, Park Lane. James Packham, 16, Katharine Street. S. L. Griffiths, 340, London Road.

April 13th.—J. G. Lincoln, Wellesley Court Road. W. E. Samson, 55, Bensham Manor Road, Thornton Heath.

May 11th.—Arthur Lloyd, Shirley Hurst, Shirley, Surrey.

September 14*th.*—Robert H. Davies, F.I.C., The Laurels, Culverden Road Balham, S.W. George Ashby Lean, 51, London Road.

October 12*th.*—Thos. K. F. Page, 24, Sydenham Road. Louis Carrington, Panmure, Tavistock Road. Rev. J. Isabell, 65, Old Waddon Road.

November 9*th.*—Charles Young, 26, Addiscombe Road. Frank Barlow, Clevedon, Lower Addiscombe Road. Frederick George Bing, 16, Lower Coombe Street.

December 14*th.*—Charles Moss, 21, Charleville Circus, Sydenham.

Library.

The additions to the Library during the year 1892 are as follows :—

From Individuals.—F. C. Bayard: Report on Thunderstorms of 1888 & 1889; The family of the late A. Carpenter: A large collection of fossils and minerals, together with their cases; J. A. Carter: Traité de Photographie; W. Crouch: Trawling in the Crouch, Oct. 10th and 15th, 1891; P. Crowley: 3 Nos. of the Bazaar Chronicle, June, 1860; J. Epps, Junr.: Sundry Nos. of Science Gossip; H. D. Gower: Photographic papers as issued; G. J. Hinde & W. M. Holmes: Sponge remains in Lower Tertiary, New Zealand; W. M. Holmes: Twelve Microscopic Slides; S. Laing: Antiquity of Man; H. F. Parsons: Report of Influenza Epidemic; Thomé's Structural and Physiological Botany; J. Prestwich: Primitive Character of Flint Implements on the Chalk Plateau of Kent.

From Societies.—British Association: Report, 1891; Particulars of Committees. La Société Belge de Microscopie: Bulletin, 8me Année & Annales, Tome xvi. History of Berwickshire Naturalists' Club, Part I., 1890. Brighton and Sussex Natural History and Philosophical Society: Reports for 1891 and 1892, 2 parts. Essex Naturalist, 9 parts. East Kent Natural History Society: Reports, 1891 and 1892, two parts. Eastbourne Natural History Society: Transactions, 1890—91. Manchester Geographical Society: Journal, 3 parts. Manchester Microscopical Society: Transactions and Report, 1891. Northamptonshire Natural History Society Journal, 1889, 1890, 1891, 12 parts. Quekett Microscopical Club: Journal, 2 parts. Reading Literary and Scientific Society: Report, 1892. La Société Royale Malacologique de Belgique: Proces Verbal, 10 parts. Royal Microscopical Society: Journal, &c., 7 parts. West Kent Natural History Society: Report 1891—92.

From Proprietors.—Entomologists' Record, 1 part; Field Club, 2 parts; Natural Science, 1 part; Science Gossip.

Exhibits, 1892.

January 13*th.*—Mr. W. Low Sarjeant, A portion of an elephant's tusk showing an abnormal condition of the centre, which Dr. Franklin Parsons suggested was due to the growth of secondary dentine.

February 10*th.*—Dr. Franklin Parsons, A bottle of water highly charged with carbon; being the melted rime from trees at Park Hill during the fog-frost of January, 1892. The President, Series of shells,

including *Pecten varius* var. *niveus*, also *Haliotis tuberculata*, and *Mactra glauca*.

March 9*th*.—Mr. Aldous, in illustration of his paper, Two old microscopes, and eleven diagrams. Mr. Epps, A solar microscope, in illustration of Mr. Aldous' paper. Mr. Sturge, Chamber's 'Dictionary of Arts and Sciences' (1738), with illustration of Marshall's microscope. The President, Collection of weapons and appliances made and used by the natives of Arctic America; extemporized microscope. Mr. Oakley, photograph of group of mushrooms grown at Thornton Heath, weight seven pounds, containing thirty-four mushrooms, largest seven inches, and smallest three inches in diameter. Mr. H. D. Gower, Photograph of *Calopteryx virgo*. Mr. Packham, Photo-micrographs of fossil wood (*Endogenites erosa*) from Wealden beds.

April 13*th*.—Mr. Sturge, Photographs, books, and pamphlets in illustration of his paper. The President, Series of Indian weapons and garments in illustration of Mr. Sturge's paper.

May 11*th*.—The President, A series of mollusca and crustacea, in illustration of his paper. Mr. Aldous, Old map of London; a naturally mummified mouse, and a portion of incrustation of house boiler. Mr. Goodman, A case of peculiar forms of insects, and a spider with spinous projections; two photo-slides of *Holobates compar* and *Holobates Wiellerstorfii*, pelagic forms of Hemiptera. Mr. Mennell, Living plants of *Primula farinosa*, also variety *acaulis*, and *Gentiana verna*. Mr. Marriott, A white sparrow, not an albino, taken at Reedham.

September 14*th*.—Mr. Sturge, Specimens of carbonate of lime from Cox's Cave, Cheddar Cliffs. Mr. H. Long, A portion of selenite (crystallized sulphate of lime), from Woodside Green. Mr. C. H. Goodman, Specimens of the Crane Fly (*Tipula*) from the pupa, and Photographs of the effects of a local cyclone near Belvedere, Kent. Mr. McKean, Specimens of *Planorbis albus*. Mr. W. Low Sarjeant, A series of land and fresh water mollusca, and a series of *Limnæa stagnalis*. Mr. Berney, A series of Lepidoptera from the New Forest, and others from Croydon. Mr. Crowley, A series of the genus *Colias*. The President, Primitive fire-making appliances from Rajpootana, and primitive wood lamps from India; Skull of leopard with malformation of nasal bone; Nests of weaver bird from the Island of Elephanta, India, and examples of protective resemblance in Lepidoptera.

October 12*th*.—Mr. Crowley, Specimen of *Zygæna filipendulæ*, taken at Riddlesdown. Mr. Murton Holmes, A spider, very red when alive, taken on Rhododendron. Mr. Aldous, Large starfish, foreign species, obtained, preserved, from a trawler at Brixham; Piece of sponge trawled up off Babbicombe; Pen-like bones from cuttlefish.

November 9*th*.—Mr. N. Waterall, Specimens of rock from the Mountain Railway, Monte Generoso, Bella Vista, Capolago, Switzerland.

December 14*th*.—The President, Dust collected from show-cases at the Soirée. Mr. Crowley, A nest of the bird of paradise (*Paradisia raggiana*), with one egg, from New Guinea. Mr. McKean, A slide of dust, deposited on a cleaned surface, at Lloyd's, between the hours of twelve and one p.m.

Croydon Microscopical and Natural History Club.—Balance-sheet for the Year ending 31st December, 1892.

Receipts.

	£	s.	d.	£	s.	d.
Balance at Bank, 1st Jan., General Account	9	19	6			
Cash in hand of Hon. Sec.	3	5	9			
				13	5	3
Subscriptions, 1890	0	10	0			
„ 1891	5	10	0			
„ 1892	123	10	0			
„ 1893	3	10	0			
„ 1894	0	10	0			
				133	10	0
Sale of Transactions...				0	8	0
„ Mr. J. H. Drage's Paper ...				4	7	10
„ Soirée Tickets				26	12	6
Donations, A. Hill, Esq.	0	10	0			
„ Philip Crowley, Esq. ...	5	0	0			
„ F. C. Bayard, Esq. ...	5	0	0			
„ Harold Smith, Esq. ...	2	2	0			
„ Baldwin Latham, Esq.	5	0	0			
„ J. Compton Rickett, Esq.	5	0	0			
				22	12	0
				£200	15	7

Expenditure.

	£	s.	d.	£	s.	d.
Rent of Club Room				10	0	0
Hire of Rooms for Meetings ...				4	10	0
Printing Transactions, 1891 ...				23	19	3
Insurance				0	15	0
Printing and Stationery				15	9	11
Postages				13	16	8
Meteorol. Sub-Committee Printing Rainfall Returns for the months December, 1891, to November, 1892, inclusive, and sundry Postages				27	5	5
Photogra. Sub-Committee; Hire of Rooms for Lantern Exhibitions.	3	10	0			
Sundry Printing and Postages, Gas, &c.	5	2	8			
				8	12	8
Gratuities				1	6	0
Printing Mr. J. H. Drage's Paper, "Pictorial Selection in Photography"				4	17	6
Soirée Expenses				36	7	0
Sundries				2	4	10
Balance at Bank	48	15	10			
Petty Cash in hand	2	15	6			
				51	11	4
				£200	15	7

SPECIAL FUND ACCOUNT, 1892.

£210 11s. 8d. CONSOLS.

	£	s.	d.		£	s.	d.
Balance from last Account, 1st January ...	22	13	0	Paid for Lantern Table	3	8	9
Dividends—Four at £1 8s. 3d.	5	13	0	,, Alteration in Notice Board	0	3	6
				Balance forward	24	13	9
	£28	6	0		£28	6	0

	£	s.	d.	£	s.	d.
Balance brought down, at Bank ...	24	13	9			
Balance General Account, at Bank	48	15	10			
				73	9	7
Petty Cash in hand...				2	15	6
				£76	5	1

EDWARD B. STURGE, *Treasurer.*

We, the undersigned, having examined the above Accounts and the Vouchers relating thereto, hereby certify that they are correct, according to the Vouchers, and to the Bankers' Pass Book.

THOS. CUSHING,
CECIL H. LANFEAR, } *Auditors.*

January 3rd, 1893.

TRANSACTIONS

OF

THE CROYDON MICROSCOPICAL AND NATURAL HISTORY CLUB.

1892—93.

102.—The Early History of the Microscope.

By Thos. D. Aldous, F.R.M.S.

(Read March 9th, 1892.)

It has occurred to me that, to a Microscopical Society like ours, some account of the history and progress of the instrument from which we take our name may not be without interest.

I have on more than one occasion been accused of spending my spare time in some "fusty old book shop," as the irreverent are wont to call those mines of entertainment and learning, which nevertheless are duly appreciated by the enquiring and intelligent man. Well, gentlemen, I do not deny the soft impeachment, and, as a result of time so spent, I have been fortunate enough to obtain a copy of a book called 'Micrographia Illustrata; or, the Microscope Explained,' published in 1771 by the elder George Adams, containing many interesting plates of contemporary instruments; 'The Microscope made Easy,' by Baker, 1742; and a very important work entitled 'Essays on the Microscope,' published in 1787 by George Adams the younger. From these, the 'Encyclopædia Britannica' of 1797, and a book kindly lent me by our President, I have been able to gather the various data relating to the history and progress of the microscope, which I shall presently place before you.

In his preface to 'Essays on the Microscope,' Adams the younger says:—"The plates were drawn and engraved with a view to be folded up with the work; but as it is the opinion of many of my friends that they would by this means be materially injured, I have been advised to have them stitched in strong blue paper, and leave it to the purchaser to dispose of them to his

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own mind." Well, gentlemen, I wish Mr. Adams's friends had kept their opinions and advice to themselves, for, as may be imagined, the plates have been very much disposed of and separated from the work, and this has given me a lot of trouble in hunting up in other contemporary works the plates he refers to, and in comparing his descriptions with the drawings and reference lettering of other men. With just this one little grumble I will pass to my subject.

The microscope was invented in the year 1590 by a Dutchman named Zacharias Jansens, and in 1619 one Cornelius Drebell brought to England, from Holland, one of these instruments. This was in all probability more of the nature of a microscopic telescope than what we understand as a microscope. It was formed of a copper tube 6ft. long by 1 in. in diameter, supported by three brass pillars mounted on a wooden base, on which the objects to be viewed were placed. This seems to be an extraordinary length of body-tube, and one is almost inclined to think, in the absence of any drawing, that, while the whole instrument may have been used as a telescope, probably the tube was removed, leaving the bottom lens on the pillars to be used as a magnifying-glass or simple microscope when small objects were to be viewed; it is from this instrument the Dutch claim to be the inventors of the microscope. The great Galileo made one in 1637.

But an Italian named Fontana, in a work published in 1646, says he made microscopes in the year 1618. This, indeed, may have been so, for instances are not wanting where two men have produced similar things at the same time; and, as a striking instance of this in our own times, I may mention those wonderful papers of Darwin and Wallace, read before the Linnean Society on the same night, July 1st, 1858.

But if we consider the microscope in its most simple form of a magnifying-glass, I think it is highly probable that it was known to and used as such by the Greeks and Romans. There are extant specimens of ancient workmanship so fine in detail that it is difficult to understand how they were carved or engraved without the aid of a magnifying lens of some sort; some of the Roman or Greek seals, for instance, which have been found, look commonplace to the naked eye, but when magnified are seen to bear work of great delicacy and minuteness, and in the writings of Pisidias occurs the passage, *Τα μελλοντα ὥς δια διοπτροσυ βλεπεις*, "You look at future things by or through a dioptrum." Now, in a somewhat aged lexicon in my possession, I find the word Διοπτρικος, which is translated into Latin, "ad spectanda remotiora aptus," which, I take it, may be freely rendered as "suitable for viewing distant objects." Why not small ones? Then turning to a Latin author, Seneca writes:—"Literæ

quamvis minutæ et obscuræ, per vitream pilam aquâ plenam, majores clarioresque cernuntur." "Letters, though small and indistinct, are seen larger and clearer through a glass bubble filled with water," which, I think, proves that the Romans, at any rate, used a magnifying-glass as such.

Now to come down to the period when the microscope began to assume a shape worthy the name we find the instrument to have been what is known as a single microscope, *i. e.*, consisting of a single deep convex lens set in metal, having a very small aperture. As early as 1656, however, we find inventive genius at work in the person of a Dr. Hooke, who, in the preface to his 'Micrographia Illustrata,' describes the manner of making tiny glass globules, and about the year 1665 these globules began to be occasionally applied to the single microscope. Of course the magnifying power of such a lens is very great, but unless Dr. Hooke was satisfied with a very small field, the spherical aberration which would occur must of necessity have made his observations somewhat distorted. Here again we find an invention attributed to two people, some affirming the inventor to have been a Monsieur Hartsoeker ; but, as the first recorded discovery of this observer is that of Spermatozoa, made when he was 18 years old, in the year 1674, he must have begun inventing very young to have been previous to Dr. Hooke's description in 1656.

To give you an example of the patience with which these early observers worked, I take bodily a description of the mode of manufacturing these globules, as given by Dr. Hooke in his 'Letters and Collections,' 1678. He says :—"Take a small rod of the clearest and cleanest glass you can procure, free, if possible, from blebs, veins, or sandy particles ; then, by melting it in a lamp made with spirit of wine or the purest and clearest salad oil, draw it out into exceeding fine and small threads ; take a small piece of these threads and melt the end thereof in the same flame, till you perceive it run into a small drop or globule of the desired size ; let this globule cool, then fix it upon a thin plate of brass or silver, so that the middle of it may be directly over the centre of a very small hole made in this plate, handling it till it is fixed by the before-mentioned thread of glass. When the plate is properly fixed to your microscope and the object adjusted to the focal distance of the globule, you will perceive the object distinctly and immensely magnified. By this means," says Dr. Hooke, "I have been able to distinguish the particles of bodies, not only a million of times smaller than a visible point, but even to make those visible whereof a million of millions would hardly make up the bulk of the smallest visible grain of sand ; so prodigiously do these exceeding small globules enlarge our prospect into the more hidden recesses of nature."

Now, gentlemen, I should be sorry to argue with a man so

much older than myself as Dr. Hooke, but I would with very great respect submit that if one looks at an object "a million times smaller than a visible point," it is necessary to magnify it a million times in order to make it appear as large as a visible point, or, in other words, to see it at all; and as with our modern instruments, using, say, $\frac{1}{18}$ oil immersion objective and a Zeis No. 5 ocular, we get an amplification of 2020 times only, I think we must make some allowance for enthusiasm in Dr. Hooke's concluding statement.

There were various makers and modifications in the details of the manufacture of these globules, and one of the most dexterous was a Neapolitan named Di Torrè, who, after giving a detailed account of the mode of their manufacture, concludes by saying:—"In damp weather, notwithstanding every precaution, it will often happen that, out of forty globules, four or five only will be fit for use."

Now we come, in the history of single microscopes, to about the year 1673, and meet a familiar name, Leuwenhoek, who made so many discoveries. He seems to have used entirely single microscopes; each of them consisted of a very small bi-convex lens set in a socket formed by two metal plates riveted together, and, of course, pierced with a small hole at the centre of the lens. He had many such instruments of varying powers to suit the various objects he examined by attaching them to a silver point or needle capable of being moved in any direction. Some of these instruments are, I believe, in the possession of the Royal Society; they did not magnify so much as the glass globules, but, as Leuwenhoek truly remarks, in a letter to the Society, "that from upwards of forty years' experience" he found that the most considerable discoveries were to be made with such glasses as, magnifying but moderately, exhibited the object with the most perfect brightness and distinctness.

Here I must mention the very ingenious device of a Mr. Stephen Gray, of Charterhouse, who in 1696, looking through a glass globule which had some defects, noticed that these defects were much magnified; thereupon he conceived the idea that if he could get a drop of water containing animalculæ, he would see them much magnified. This he did by getting a drop of water known to contain animalculæ on the end of a piece of brass wire, and he says:—"On applying this to the eye he found to his astonishment that those scarcely discernible with his glass globules appeared as large as ordinary-sized peas." Another enthusiast. Still, the idea was ingenious; and he went further, for he contrived another water microscope, consisting of two drops of water separated in part by a thin brass plate, but touching near the centre, which were thus rendered equivalent

to a double convex lens of unequal convexities, almost reminding one of a Coddington lens.

Dr. Hooke, too, describes a method of placing his glass globules in contact with water when examining that fluid, and speaks of the clearness and brightness gained by this means.

In 1702 we have Wilson's microscope. This was an altogether more elaborate instrument, consisting of an object-lens, an object-holder, a screw for focusing, and a condensing lens.

In 1738, Dr. Lieberkuhn made the greatest improvement the single microscope received, and that, one which had from the beginning been wanted, in that he placed the small lens in the centre of a highly polished concave speculum of silver, which, by reflecting light on to an opaque object placed underneath it, opened up the possibility of examining such objects, thereby placing a huge new field of research within the reach of microscopical workers of the time. On this account I need hardly point out this instrument obtained and maintained a high reputation, so much so that nearly all the compound microscopes subsequently made were by a simple device rendered capable of, on occasion, supplying a Lieberkuhn's single microscope. This great man made three forms, but I have only taken two of them, as amply illustrating his invention.

Then, in 1740, we find a somewhat elaborate single instrument brought out by the elder Adams, which he called the Universal Single Microscope; the whole of the magnifiers were mounted on a revolving wheel, by which means they might be readily brought under a fixed eye-piece, which was also supplied with a speculum for opaque objects, the whole being mounted on a pillar and illuminated by a mirror.

In 1742, Benjamin Martin, of Reading, invented a botanical magnifier, which caused a good deal of interest at the time, and is now largely used; in fact, I suspect that at the present moment many of us have a specimen of the instrument in our pockets.

In 1747, Cuff the optician improved, at the suggestion of Mr. Martin Folkes (who was President of the Royal Society in 1742), the pocket microscope of Wilson, by fixing it to a stand, and adding a mirror for illumination; and subsequently further improved it by mounting the lens on a moveable arm, and making a stage to slide up and down on a square stem. This was the instrument used by Mr. Ellis in his examinations of corallines and zoophytes in 1756.

Then we have the microscope invented by Dr. Withering, consisting of three plates, the upper and lower of which contained a lens; the middle plate or stage was moveable on the stout wires supporting and connecting the top and bottom

plates, and by sliding this up and down the object was brought to focus.

There were other modifications of the various instruments I have mentioned, but I think I have taken the chief types; and of these I have prepared some diagrams, to which I would now direct your attention.

Of the double or compound microscope, consisting of two, three, or more lenses, the earliest recorded examples are those of Dr. Hooke, 1665; Eustachio Divini, 1668; and Philip Bonani, 1698.

Dr. Hooke's compound microscope was composed of three lenses, the object-glass, a middle or field lens, and an eye-glass; it was about three inches in diameter and seven long, and was furnished with four draw tubes. In his work, 'Micrographia,' Dr. Hooke gives a method of examining opaque objects by placing a globe of glass filled with brine immediately in front of his lamp, the pencil of light from this globe being received by a small plano-convex lens with its convex surface turned towards the globe, thus concentrating the rays on to the object, which, I need hardly mention, is practically the same as that used to-day. Dr. Hooke states that when he wished to examine an object with greater accuracy, he removed the middle glass, by which means he obtained more light and better definition.

The microscope of Eustachio Divini must have been a somewhat remarkable instrument; it, like that of Dr. Hooke, consisted of an object and field glass, but instead of a double convex eye-glass, he substituted two plano-convex lenses, which touched each other at the centre of their convex surfaces. This was an improvement, as by this arrangement a flat field was obtained with a considerable increase of magnifying power. By means of four draw tubes Divini obtained amplifications of from 40 to 143 diameters. When the draw tubes were all closed the body was 16 in. long, and magnified 41 times, at the second length 90, at the third 111, and at its fourth and greatest expansion 143; the body-tube was a large as a man's thigh, and the eye-glass was equal in size to the palm of the hand. Altogether it must have been an imposing instrument, 1668.

When writing the above I much regretted being unable to show you a drawing of this instrument. What, then, was my delight the other day to find that almost as I was writing, Sig. P. A. Saccardo found preserved in the Museo di Fisica, Padua, an ancient microscope bearing the inscription, "Eustachio Divini in Roma, 1672." A drawing of this instrument appeared in the December number of the 'Royal Microscopical Journal,' and to that most excellent publication I am indebted for the copy of the enlarged sketch now before you.

The measurements of this instrument are as follows:—When

all the draw tubes were closed the length from eye-piece to objective is 36·5 centimetres, or 14 in. when all were drawn out as far as the marks I, II, III, IV; the total length is 41, 49, 54, 56·5 cm. respectively, or, expressed in English inches, 16 in., $19\frac{1}{4}$ in., $21\frac{1}{2}$ in., and $22\frac{1}{4}$ in. The body of the instrument is of cardboard, covered with parchment coloured green and gilded; the largest tube has a diameter of 8 cm. or $3\frac{1}{10}$ in., and the lowest tube carries on its lower half a broad spiral band of cardboard, also covered with parchment, which gears into a spiral cut in the cardboard cylinder, round which is the brass band bearing the inscription; the three brass legs are 15 cm. or $5\frac{9}{10}$ in. long. The objective, a biconvex lens, is held in position at the bottom of the screw tube by a screwed cap, and the object is focused by turning the object-holder up or down by means of the screw on this tube, which is $2\frac{1}{10}$ in. long, and 1 in. in diameter. The eye-piece is missing, and the field lens is a large somewhat yellow biconvex one, 6 cm. or $2\frac{3}{10}$ in. in diameter, and 5 mm. or $\frac{1}{5}$ in. thick. These measurements agree practically with those of the instrument I mentioned above, except the tube is not as large as a man's thigh; this, I think, must be an exaggeration.

The microscope described by Philip Bonani fifty years later was, as far as the lenses were concerned, similar in construction to the foregoing, consisting of an object-glass, a middle or field-glass, and an eye-lens; but the form of mounting was different, in that he placed the body in a horizontal position. It was also provided with a stage for the object, and with a coarse and fine adjustment for the body; the former was rack and pinion, and the latter was effected by a screw on the body at the objective end, and finding, doubtless, that the weight of the body, especially when the fine adjustment was back, made his instrument somewhat unsteady, he introduced a triangular support near the eye-piece, in which, of course, the body could be easily moved backwards and forwards in obedience to his fine adjustment screw. Bonani seems to have worked with direct light, and between the lamp and the stage he placed a short tube containing two double convex lenses; in fact, he introduced a substage condenser. This instrument was, to my mind, at any rate so far as the mechanical part went, a very long step in the direction of improvement.

We find no further record of any importance from this time till 1702, when Jean Zahn published a work at Nuremberg, describing, amongst many others, two *binocular* microscopes, and also a figure of one by Francis Grindelius, used for opaque objects; its optical parts consisted of six plano-convex lenses, placed as shown in the drawing, but he gives no record of its size. And in the same year, Mr. John Marshall brought out his microscope, which, however, from its unwieldy nature, was

very little employed; it is, however, interesting from the fact that it is the first compound instrument made for sale in this country; also as the first appearance of an ordinary condenser such as we now use. After this—in England at least—nothing seems to have been attempted in the direction of improvement to the compound microscope for about thirty years.

But the year 1738 is historical from the publication of Lieberkuhn's invention of the solar microscope, which the inventor himself exhibited before the Royal Society in London in 1739; this was, in fact, the first projection microscope. Lieberkuhn illuminated his solar microscope by the sun's rays falling directly on a condensing lens, and so its use was limited to a short period of the day. About 1747, however, Cuff greatly improved the apparatus by applying a moveable mirror, thus making it available for general use; it was principally used for the exhibition of animalculæ and the circulation of blood, and was much recommended for drawing purposes, the image being thrown on a thin sheet of paper, the artist standing behind the screen and tracing the outline with pen or pencil. This invention, together with the discovery, by Mr. Trembly, of the *Plumatella,* a fresh-water polype, about this time, and also the observations of Baker and the elder George Adams, gave to microscopical research a tremendous spur.

In 1740 the cumbrous compound instrument of Marshall was greatly improved and reduced to manageable size by Scarlet and Culpepper, after the latter of whom the instrument was named; their first microscope had a wooden body, but this seems to have been at once replaced by metal, as in 1742 Baker describes the instrument as of brass. A specimen of this instrument, *singularly complete,* I am able to show you; it is probably of rather later date, but not much, as those made in 1771 by the elder Adams have a cross-shaped stage instead of this circular one. The whole is exactly similar to that described by Baker, the only difference being in the scrolled supports, which are illustrated in his 'Microscope Made Easy' as straight.

"In 1744," says Baker, "I found, however, some further alterations were necessary to make this instrument of more general use, as I fully experienced in 1743, when examining daily the configurations of saline substances. The legs were continual impediments to my turning about the slips of glass; besides, pulling the body up and down was likewise subject to jerks, which caused a difficulty in fixing it exactly at the focus. There was also no good contrivance for viewing opaque objects." Baker applied to Cuff, the optician, with the result that he produced an instrument supported on a sliding pillar, and fitted with a fine adjustment.

At this time microscopy seems to have been given another

rest, and nothing of importance was done till 1770, when Dr. Hill published a treatise on the structure of timber. So important a subject revived the ardour for microscopic pursuits, and we find about this time the elder Adams contrived a microtome for cutting transverse sections of wood, which instrument was improved by a Mr. Cumming, and also later on by the younger Adams.

In 1771 the elder Adams published a fourth edition of his 'Micrographia,' in which, amongst other appliances then in use, he describes a contrivance of his own for applying the solar microscope to the camera obscura, and illuminating it at night by a lamp, by which means a picture of microscopic objects might, he says, be exhibited on winter evenings, and also the variable microscope.

It seems that Lieberkuhn had adapted his solar microscope for viewing opaque objects; but the contrivance was lost. Knowing, however, that this had been done, a certain M. Æpinus turned his attention to the subject, and in some measure succeeded; but his success seems to have been marred by employing a too small illuminating mirror. Some further improvements were made by M. Ziehr. But the most perfect instrument of the kind was that described by Mr. Benjamin Martin in 1774. In 1777 we have Dellebarre's microscope, and in 1784 M. Æpinus describes some newly invented microscopes in a letter to the Academie des Sciences of St. Petersburg, about which the younger Adams makes some rude remarks as to their being simply the application of the achromatic perspective, long known in regard to telescopes, to microscopic purposes.

This, gentlemen, brings us to what we may call the end of the history of the microscope in the unachromatised state, and I think that when we look at the wonderful and good useful work done by our forefathers, and compare the instruments at their command with our present day microscopes, we cannot but admire their courageous researches, and reverence their memory as the founders of a science which has had, and is having, not only an interest for those wishing to see Nature in detail, but has enabled us to discover much which has been a real benefit to the health and life of man.

103.—Abnormal Forms and Variations in the Animal Kingdom.

By Edward Lovett.

(Read May 11th, 1892.)

The following observations are compiled from notes made by me from time to time, when I had opportunities of doing a little practical work amongst Insects, Crustacea, and Mollusca.

Examples of deviation from the normal type are always interesting, whatever may be the cause of such deviation, and there are several, for example, albinism, melanism, mimicry (so-called), deformity, and true variation, to which latter I wish specially to refer.

Albinism is the name given to that remarkable white form which frequently obtains amongst many animals, whilst melanism is the exact reverse of this, being the dark or black variety. Mimicry, or, to use a better though longer expression, the approach in resemblance, through a long process of natural selection, of one species to another, or to some other object, for the purpose of self-interest, offensive or defensive; mimicry, I repeat, appears to come so very close to true variation that it is difficult to dissociate it, though it is not my intention to deal fully with this aspect of the subject, but more to the influence of other external conditions in bringing about variations or deviations from the type of the species subject to those influences. As regards what may be called deformities, these can be dismissed altogether from our consideration as being in no sense of the word true variations. Deformities are either the result of imperfect development, accident, or monstrosity, and, if capable of reproducing their species at all, which in the majority of instances is doubtful, would not be at all likely to reproduce the aberrant features or peculiarities which they themselves possess; whereas true varieties possess deviating characteristics which do not in any way interfere with the functions of life, but, if anything, permit such functions to be carried out with greater safety, and with more facilities, than when the species in question was not in such complete accord with its surrounding conditions. As examples of deformities may be instanced a decapod or ten-footed crustacean with *eleven* legs, an example of which is in my collection; abnormal growths of the limbs of crustaceans, which very frequently occur through accident; butterflies with hermaphroditic tendencies, or with imperfect or too many wings, such as exist in many collections, and which, I regret to say, are considered of great value. Amongst Mammalia and birds such deformities assume a variety of repulsive forms, as may too frequently be seen at country fairs; such cripples are of no value in any way whatever, and are only calculated to degrade the observer of them.

We will now consider the question of true variation, by which I mean the deviation from the normal type in consequence of some perfectly natural condition, which condition, however, is, from some cause, different from that to which the varying species has become adapted; or else some condition or conditions which, though to a certain extent artificial, do not in any way interfere with the chief life functions of the species in question.

Mr. Herbert Spencer has defined life as that in which an organism is in perfect correspondence with its environments or the continuous adjustment of internal relations to external relations. A good illustration of this is the case of a man and a fish. Both live by breathing oxygen, but one breathes by means of lungs and the other by means of gills. If, therefore, the one breathing by lungs exchanged places with the one breathing by gills, both would cease to live, because neither would in that case be in correspondence with its environment; or, in other words, there would be a violent interruption in the continuous adjustment of their internal to their external relations. On the other hand, however, if the correspondence with the environment can be kept up by a modification of one or the other, or both, or if the adjustment of the internal with the external relations can be effected, then life is not extinguished, but a variation takes place, and existence goes on upon a different basis. For example, it has been recorded that a lizard (*Axoletus*, I believe), breathing in water by means of branchiæ, by being gradually weaned, so to speak, from its aquatic life, became perfectly terrestrial, and lost its branchiæ altogether. For such a thing to occur in one individual is remarkable, and helps to show what might take place through a long series of generations under varying conditions of existence.

I will divide the few observations I have to make into two sections for convenience, *viz.*, variation of form or structure, and variation of colour and markings. As to the former, I will begin with a very common mollusc, the observation on which I have already briefly described before this Club; but before doing so I should like to say a word or two as to the terms common or rare as applied to any organism. It must be borne in mind that these terms are very general, and must not be taken to mean exactly what they seem to; for if any species became really rare, it follows that it must rapidly become extinct. No doubt many species occur in far greater profusion than others, but on the other hand, many so-called rarities exist also in profusion, but out of the reach of man. This applies chiefly to marine organisms, Crustacea, Mollusca, &c.; and, as an illustration, I will mention two instances of my own experience. The large bivalve, *Mactra glauca*, has always been quoted as a great rarity by authorities, even in the Channel Islands, where I found it.

I, however, know of a sand-bank on the Jersey coast, which I visited at low tide on one occasion, where I found this rarity in such abundance that I have no hesitation in saying that I could have filled a bushel basket with them in a very short time. The other case was that of a crustacean, *Stenorhynchus Egyptius*, which had not hitherto been described as British. A dredger brought up, amongst other material, about a hundred of this species, until then never seen in our seas.

Now to revert to the common mollusc already referred to. It is *Patella vulgata* and its allied *Patella athletica*, the limpet, a very common shell, or rather a shell which lives in such a position as to be met with by man. I consider it possible, too, that if a very large collection of Patellas was made, from every possible locality, it would perhaps be difficult to say where *P. vulgata* left off and *P. athletica* began. The observation I made with regard to this species was this, that where the animal was fixed to a rock in such a position as to receive the full force of the sea, the form of the shell was conical or elevated, whereas the shells of animals fixed upon flat shelf rocks, or upon the sides of gullies, where the impact of the sea affected them laterally, were much more flattened or compressed.

It is obvious that vertical force is best resisted by a tall or conical form, and lateral force by a flat one; in other words, unless these Patellas had adjusted their structure to their external relations during their growth they would probably have ceased to exist at all, but, having done so, they part company as regards similarity in form; and it would not be a very unwarrantable thing for a species-making naturalist to call one *Patella depressa* and the other *Patella elevata*.

Another mollusc, very largely sought for and met with, and therefore called common, is the whelk, *Buccinum undatum*. (I select common species, because we see more examples, and therefore understand the pros and cons of their variations better.) This species is very largely obtained from the North Sea, and it develops a remarkably fine shell, and, in fact, seems to be in complete correspondence with its surroundings on the Dogger Bank.

Now, if we go south to the Channel Islands, where so many fine and beautiful Mollusca occur, we find *Buccinum* a weakly, puny shell, as unlike a good North Sea whelk as two species; so that it is evident that the bright warm waters of the sunny south are, for some reason or other, not in complete correspondence with the internal relations of this species; hence a marked variation which might, with very little imagination, become a named variety, and then, of course, another species.

Another common mollusc, the mussel, *Mytillus edulis*, is very

constant in form when in enormous masses, as it usually is found in. When, however, it occurs in very small numbers, or even in ones and twos, as it does on some parts of our coast, the form is always abnormal, being most curiously twisted, curved, and depressed. Now this form, or variety of forms, for there are really seldom two alike, has actually been named, so it is on its way to becoming a species; whereas there is, I think, little doubt but that these isolated specimens are the remnants of large mussel-beds that have disappeared in consequence of their surrounding conditions having become unfavourable, and that the few that have survived have done so because there has been a gradual attempt through many generations to conform to the new surroundings, whatever they may be, and the alteration in structure and paucity of survivors seems to show that the struggle to adjust the correspondence is a severe one, and that, so far as those particular localities are concerned, the species and the variations are doomed to extinction on the ground that a form that exists only in ones and twos, and under adverse conditions, cannot survive.

There is one other instance that I would wish to quote before leaving the Mollusca, and it is the question of abnormal forms of *Buccinum* and *Fusus* from estuarine localities, and the sinistral forms of both these and other genera.

I have a remarkable series of *Buccinum* from the area of the Thames and Medway estuaries. Many of these are sinistral, whilst many of the others are exceedingly curious in form, some being elongated, others approaching the shape of a *Murex*. There is little doubt that an estuarine area is not conducive to the normal growth of this genus, and the endeavours to adjust itself to its external relations, or, in other words, conform to its environment, results in the deviations from the normal type which we see from such localities. I may mention that abnormal forms or variations of any kind of this species from the North Sea are extremely rare.

As regards sinistral forms, it is very difficult, if not impossible, to attribute this peculiarity to any cause, and I consider it as a mere sport, and not a true variation in any sense of the word; and yet it is a sport of a most remarkable nature. In the geological deposit known as the Suffolk Crag, for example, the typical representation of *Fusus antiquus* is sinistral, whilst dextral forms of this species are rare. In our recent seas the reverse is so much the case that a sinistral form is of exceeding rarity, in fact, almost unknown. It would really seem as if some physical cause existed to account for this strange reversion of condition or form in one species.

In crustaceans, variations of form are not so noticeable, for the simple reason that we see so comparatively few of even the

most abundant species, and they appear as a rule to be living in complete correspondence with their environment; and the same remark holds good with the Echinodermata. It would be beyond the scope of this paper to enter into particulars as to the life-history and surroundings of these groups, but could it be possible to form very large and complete collections of their representatives from all parts of the world, a thing that has never been even approached, I venture to think that we should find it extremely difficult to make a line of demarcation between species. One British species, a *Xantho*, has been named *X. tuberculata* merely from the observation of one or two specimens; whereas I consider, from a careful examination of its allied species, *X. florida* and *X. rivulosa*, that it is either an immature form, or a variation of one or the other, and nothing more.

Another crustacean, *Dromia vulgaris*, though common in the Mediterranean, is not often met with in our seas, and it would appear that, in company with one or two echinoderms, it was gradually reaching this area from the south. What, however, is remarkable is that of the few that have been obtained in the Channel there are many that are larger than any seen from the Mediterranean, from which it would appear that the new surroundings found by the species in its extended area were more congenial to its welfare, and enabled it to develop into a finer example than the warm waters of the Mediterranean, although it would certainly seem as if exactly the reverse of this ought to be the case.

We now come to the question of colour and markings of an abnormal character, or varying from the type. Much has been written upon this, especially in regard to the subject of protection. I do not intend to go over what is well known, but merely record a few of my own observations, as in the former case. The absence of colour in organisms living almost without light, or practically speaking, in the dark, is a well-known and general fact; and the whiteness of some Mollusca, not living in the dark, and not naturally white, may be due to albinism. It is also well known that bright light is favourable to the development of bright colours, as is well seen by comparing specimens of organisms from tropical, temperate, and arctic areas.

In many Lepidoptera there is a boreal form. Take, for example, the ghost swift, *Hepialus humuli;* even in these islands we find the type to be a southern insect, whilst a dark variety occurs in the north.

The bands on some of the bivalve Mollusca, which occur as a variation, not being seen in the type, are as yet difficult to account for, as they are not sufficiently general; but some time since, whilst at Cullercoats, near the mouth of the Tyne, I observed the fishermen baiting their hooks with a mussel, of

which they had large numbers, and which, instead of having a hard blue-black shell, possessed a thin yellowish brown shell, in many cases beautifully banded. So far as I could ascertain, these mussels were obtained from a very dirty and brackish water locality; whether that was the cause of their variation I do not know, but the variety certainly occurred in sufficient numbers to be honoured with a name, if not to form a species. No doubt the external conditions had been changing, and influenced a *pro rata* adjustment of the internal condition, or secretory organs, of the animal. I am inclined to think that the geological character of a locality has some influence upon the organisms living in that locality. Of course this is undoubtedly true of land organisms, for the simple reason that an animal keeps to where its food-plant is. But in regard to marine organisms, this is different, at least to a very great extent. If, however, we take a very common crustacean, *Carcinus mænas,* which occurs on all parts of our coast near tide-mark, irrespective of whether the locality be clay, sand, limestone, or granite, we find that there is a decided character of colour and markings, according to the nature of the rocks of the place from which the specimen is obtained; the markings being brilliant on those from granite areas, almost black and very dull from clay or muddy shores, and tawny from yellow ones. This, of course, is due to adaptation to surrounding conditions.

Burrowing crustaceans possess no bright colours, and their dull tints almost invariably correspond to the colour of the material into which they burrow, thus showing complete correspondence, and therefore life in, so far as this class is concerned, its safest aspect.

It seems probable that climate has a marked effect on colorization, and perhaps markings too; certainly the proximity to the sea has, for when visiting the Farne Islands I examined the sand-dunes on the shore near Bamborough, where I found many hundreds of the little banded snail, *Helix nemoralis*, of almost every possible variety of colour and markings, many of them very beautiful; but the typical form of this species was positively absent, there were none; nor do I know of any inland localities where the varieties I found occur. In the Channel Islands many of the land shells are different from the normal inland type; indeed, there is a named variety of the garden snail, *Helix aspersa,* which will perhaps some day rise to the dignity of a species. As regards climate, I think there is little doubt that even such causes as difference of rainfall would produce variations in the animal life of a given area. Of course, temperature has a very great deal to do with the variation of species; this needs no illustration, as it is well seen in the varying fauna of the great zoological divisions of the world. When therefore we

come to consider the causes which produce variation, *viz.*, geological, proximity or distance from the sea, temperature, rainfall, and excess or absence of bright sunshine, it is not difficult to imagine that species are the fixed points or resting places of such variation; as such species begin to adjust themselves to their new conditions as soon as these conditions begin to change or become abnormal.

These few observations naturally lead up to a few words, in closing, upon the basis upon which zoological collections should be formed, so as to be of real use in helping us to understand the subjects to which they refer better than we do at present. Nearly all collections are made upon the basis of systematic classification, from which it follows that one good collection of, say British, Lepidoptera is very like another, and so on. All the well-known ground is gone over, over and over again, and if a collection happens to attain to the proud distinction of being considered better than another, it is probably because it contains a longer row of one or two recognised good things, or a few abnormal forms, perhaps cripples, monstrosities, or hermaphrodites.

Suppose, however, in the case of insects, a collection is devoted to one genus—say, the Pieridæ, or white butterflies—and that representatives of this genus be obtained from all parts of the world where it occurs, and from all varying physical localities, might it not be possible to obtain in time such a collection as would render it difficult to say that there was such a thing as species at all? Even if circumstances rendered it necessary to confine such a collection to the British Islands, it would be of great interest to see large series of common insects from every possible sort of locality, or collected under various conditions of the seasons.

Then there is the rearing of specimens under artificial or abnormal conditions, by which means variations can be produced; such specimens, with record of the circumstances by which they were obtained, would also be of great interest and scientific value.

As I have already stated, it is those species most abundantly met with where we may expect to meet with variation, and it is only in large series, widely collected and carefully arranged, that we may be able to trace out such local variation, and there is no difficulty whatever in collecting in this manner. There seems to be no question that collections illustrating and thoroughly working out one group, family, or genus must be in every way more valuable, more instructive, and more interesting than mere typical collections which show nothing but what has been seen before.

104.—On the Microscopical Structure of Hearthstone from Betchworth, Surrey.

By W. Murton Holmes.

(Read September 14th, 1892.)

Immediately overlying the beds of gault clay at Betchworth is a layer of rock some ten feet in thickness, belonging to the upper greensand formation, known as hearthstone.

The underground workings for this hearthstone were visited by several members of this Club on August 1st. They extend for some little distance into the escarpment, from the summit of which, on a clear day, there is a magnificent view across the Weald.

The hearthstone, when first quarried, is of a dull greenish colour, and soft earthy consistence, easily crumbling between the finger and thumb. When dry, it is of a greyish or buff colour, and somewhat harder. Treated with hydrochloric acid, a portion is dissolved with effervescence, indicating the presence of calcareous matter.

Examined with a lens, it shows numerous dark specks in a light-coloured matrix, with here and there a glittering particle of mica. In order to examine it more conveniently, a small lump was carefully disintegrated under water, and, by means of fine gauze and decantation, was divided into five portions, so that the particles were of tolerably uniform size.

The first and second portions consist of the coarser particles, and are of a buff colour. The third portion is much darker in colour, and contains the great bulk of the dark particles previously mentioned. The fourth and fifth are much paler in colour, and consist of the finest particles. Assuming the bulk of the first portion, after being allowed to settle, to be represented by 1, that of the second would be about $2\frac{1}{2}$, that of the third 5, that of the fourth 5, and that of the fifth and finest 2.

These figures are fairly approximate, but it would have been more accurate to have dried and weighed the various portions. The coarsest portion consists principally of particles of mica, some colourless, some brown, and others of a greenish tint. Foraminifera are also present in fair abundance, and some in a good state of preservation. They belong to the genera *Globigerina*, *Textularia*, *Pulvinulina*, and *Rotalia*. Casts of the same in glauconite are also present. The remaining particles consist of fragments of sponge spicules, in many cases showing clearly the central canal, which is occasionally filled with glauconite. The fragments are frequently covered with spherical or disk-like particles of silica. With the exception of the mica, most of the

particles showed traces of organic origin. The second portion has a similar constitution, but the particles are somewhat smaller. The third portion consists principally of grains of glauconite, and, as this mineral is very abundant throughout the greensand formation, I propose to discuss its constitution rather fully.

The mineral receives its name from its green colour, and it occurs in small grains or in masses formed by the union of several grains. It occupies a prominent position both in space and time, its occurrence extending from the Cambrian period to the most recent post-tertiary layers. Concerning the manner of its formation, there has been much controversy, without any very definite solution being arrived at.

Messrs. Murray and Renard, in their Report on the Deep Sea Deposits collected by the 'Challenger,' have paid great attention to this subject, and I have received great assistance from this volume. They state that the grains of glauconite are generally homogeneous, and are almost always accompanied either by quartz, orthoclase, white mica, plagioclase, hornblende, magnetite, garnet, epidote, tourmaline, zircon, or fragments of ancient rocks such as gneiss, mica-schist, chloritic rocks, granite, diabase, &c., and in modern deposits by organic matter, often of a vegetable nature.

Dr. Hinde called the attention of this Club, in 1886, to the occurrence of sponge spicules containing this mineral in the firestone rock of Godstone, and two years ago I read a short note on glauconite casts from the same locality.

Firestone appears to differ from hearthstone by containing less lime in its composition, and by its much greater hardness when dry.

Glauconite, both recent and fossil, consists of a hydrous silicate of potash and ferric oxide, with variable quantities of alumina, ferrous oxide, magnesia, and often lime. It is formed in the cavities of foraminifera, sponge spicules, and other organisms, but as to the conditions which determine its formation little is known. The shells and other organisms in which it is formed are sometimes broken by the growth of the glauconite, and the isolated cast then becomes a nucleus upon which fresh additions may be deposited. Although generally found associated with foraminifera and other organisms, the mere presence of these is not in itself sufficient to cause its formation, as it is absent in many coral muds and sands, and in many pteropod and globigerina oozes. It is never formed in a free state in the mud. Glauconite is one of the restricted number of silicates formed at the present day on the sea-bed, not universally distributed, but limited to deposits now forming in relatively shallow depths in more or less close proximity to continental land, and especially along those high and bold coasts that are

removed to some distance from mouths of rivers bearing abundant fine silt into the ocean.

In the hearthstone, glauconite occurs in the form of short cylindrical rods, sometimes branched at one end, which have evidently been formed in the cavities of sponge spicules; and also in more or less rounded grains, in some cases exhibiting plainly the contour of foraminifera, in the cavities of which they had been formed.

The fourth portion consists of the smaller forms of foraminifera, such as globigerina and textularia, and of numerous disc-like bodies or spherules, which are undissolved by acid, and are stated by Dr. Hinde to be derived from the solution of the silica of sponge spicules and of other silica in a hydrous state, and its subsequent deposition in this form. Many of these spherules exhibit a radiating structure, which is evidently due to a form of crystallization.

The fifth and finest portion consists principally of coccoliths interspersed with rhabdoliths. These bodies are extremely minute, and play a most important part in all deep-sea deposits, with the exception of polar and subpolar regions. Coccoliths are oval calcareous disks, having a thick strongly refracting rim and centre, and are the disintegrated remains of a spherical body known as a coccosphere. Rhabdoliths consist of minute calcareous rods, having a disk at one end, and are the disintegrated remains of a body called a rhabdosphere.

There has been considerable doubt as to the nature of coccospheres and rhabdospheres, but they are now regarded as pelagic algæ. Rhabdospheres are developed in equatorial and tropical regions, and are rarely met with where the temperature of the surface-water falls below 65°. Coccospheres, while abundant in the tropics, are found further north and south than rhabdospheres, and are present where the temperature is as low as 45°. They attain their greatest development in temperate regions, but are absent in water affected by rivers.

There is something very remarkable in the fact that such minute and fragile bodies as coccoliths and rhabdoliths should be able to withstand the action of time, when siliceous bodies such as radiolaria, diatomaceæ, and sponge spicules, which must have existed in the same waters, have either entirely disappeared, or become so much altered as to be recognised with difficulty.

We are now in a position to make a scientific use of the imagination to picture what the conditions must have been which existed at the time this deposit of hearthstone was forming. This layer of about ten feet must have been many years in the course of formation. Generation after generation of sponges lived at the bottom of that sea, which rolled in all probability where we now are. In that sea foraminifera in countless

myriads lived and moved, and had their being, falling some 100 to 450 fathoms to the bottom when their little life was ended, and the surface must have been bathed in such sunlight as we here in England have now no practical experience of.

105.—Observations on the Emergence of the Crane Fly, Tipula oleracea.

By Chas. H. Goodman.

(Read September 14th, 1892.)

On the 26th May, and at subsequent dates till 13th August, I took some crane-fly larvæ (*Tipula oleracea*) under the turf of my garden, and put them into a breeding-cage for observation. On the evening of 26th August two imagines emerged from the pupæ about 8 p.m. after dark, one of which I was able to watch. The pupa worked its way up till it projected about half an inch above the surface ; a small split at the head and back then took place, and the fly began to emerge. This was effected by gentle lateral movements, with intervals of rest, and occupied altogether fifteen minutes. The legs and wings were, of course, folded close to the body, which appeared unduly attenuated as it mounted higher and higher, the grey-coloured abdomen being marked with at least five wide black transverse bands. Before the body was fully extricated, and while the long legs were still held by the pupa-case, the wings were slightly loosened, but not sufficiently to be of any service. As the pupa was standing in bare soil, and not surrounded by grass, it became a matter of interest what would prevent it falling over; in time, however, it was projecting sufficiently far to enable the fore legs to be withdrawn, and then the second pair. They soon appeared to become firm, and were stretched out till they came in contact with the sides of the box, some three-quarters of an inch distant. By the support thus gained, the hind legs and the rest of the abdomen were quickly withdrawn, and the fly scrambled up the side to rest, the long heavy body hanging down. The wings gradually extended, still being kept folded over the back; but by the expiration of half an hour the abdomen had considerably contracted, the broad black bands being reduced to narrow lines, till merely its tip was visible beyond the wings, and a short time after the *Tipula* was ready to fly.

It may be desirable to add that the eggs, which are very numerous, are small, black, and shining, and are laid in the

autumn either on the ground or among the herbage close to the ground.

The larva changes to a pupa between July and September, and eventually works its way to the surface by means of the small teeth with which it is furnished.

106.—On some remarkable Fire-making Apparatus from Rajpootana, India.

By Edward Lovett.

(Read September 14th, 1892.)

I have recently obtained a somewhat unusually large series of fire-making appliances from the province of Rajpootana, North-west India. These are chiefly remarkable on account of the fact that they represent, in a very marked manner, the two chief primitive methods of fire-making, namely, by percussion and friction. When, however, we consider the gulf that divides not only the different races, but even the castes of India, it is not surprising to find widely divergent ethnological characteristics in a comparatively small area. In describing the specimens to which I have referred, I will in the first place take those that belong to the percussion method of fire-making. These are, as might be expected, made and used by a low caste of Hindoos inhabiting the villages north of the town of Neemuch, and, in fact, the whole of this portion of N.W. India. They consist of a series of bags and pouches, containing in the latter case a flint and steel, and in the former a flint and steel, a hand-pipe, and a quantity of dried leaf rubbish, which is used in the pipes as a substitute for tobacco. It is worthy of observation that the steels are of very poor metal indeed, not very suitable for obtaining the necessary spark; whilst the flint is represented chiefly by another form of silica known as chalcedony, occasionally varied by quartz, and even by a cherty kind of hornstone, such substitutes for true flint being common in India, where, so far as I am aware, flint from cretaceous beds is not known. The tinder and fuses of these curious fire-bags is of a very primitive description, and the specimens indicate how little the contact with Europeans has so far modified their aboriginal customs; for we may be certain that these specimens are practically similar to those that have been in use in this part of India for an exceedingly long period.

We have now to consider the next series, which produce fire

by the friction method. I need hardly state that these were obtained from a Bheel tribe, an aboriginal people of India; so that in all probability this method is with them many thousands of years old. The chief point of interest in connection with this fire-stick is that it is exactly the same kind, and is also worked in the same manner as that employed by many African tribes, by some of the Aborigines of Australia, by some of the Mongolian Eskimo peoples, and by the Zuni and other races of North American Indians.

The apparatus, which is very simple, consists of a twirl stick of very hard wood, which is worked by the hands of two operators, in a softer piece of wood, which is known as the "hearth"; the heat thus generated ignites the fine particles of the softer wood rubbed off by the twirl stick, and these fall down a notch cut for that purpose on to the tinder which is placed to catch the spark. The hard twirl stick is of a tree *Tectona grandis*, and the "hearth" is of the wood *Zizyphus jujuba;* and I am indebted to Mr. Mennell for the following notes on these two interesting woods:—

"The teak is *Tectona grandis*, 'Tecca' the native name in Malabar. It belongs to the natural order Verbenaceæ. *Zizyphus jujuba* is the jujube tree, bearing an edible fruit much used in Syria, Turkey, &c., of which it is a native, and introduced into Italy, Spain, &c. It belongs to the order Rhamneæ, the same as our buckthorn (*Rhamnus*); it is a small tree, 20 ft. high. Another species, *Z. sinensis*, is a native of China. Another, *Z. lotus*, bears the lotus fruit of the 'lotus eaters,' or Lotophagi. But my authorities say nothing about fire-making."

107.—Abstract of Paper on the Mouths of Insects.

By C. H. Goodman.

(Read October 12th, 1892.)

Notwithstanding the great diversity of form that occurs in the mouths of insects, it can be shown that they are all built up on one type, the divergence being occasioned by the suppression or great development of some one or more parts, so as to adapt the trophi to the needs and habits of each particular group. Where no food is required, there is little or no development.

The division into mandibulate and haustellate is a natural one, and by a study of the Coleoptera, in which a fairly typical mouth may be found, the way is paved for an understanding of

other orders in which the excessive development of some organs is more marked.

A typical mouth consists of a pair of mandibles working laterally, covered by a roof-piece called the labrum. Below the mandibles are another pair of jaws, the maxillæ, with the lower lip, the labium. Both the latter have appendages called palpi.

Coleoptera.—Beginning with the mandibles, we find three forms: carnivorous (tiger beetle), vegetable (cockchafer), insectivorous (dragonfly). In each case they are unjointed, move backwards and forwards only by a ginglymus joint, and have no appendages, except a small feathered cartilaginous process found in the Staphylinidæ, and known as the prostheca, and a yellow sac, which occurs in *Blaps*, the use of which is not apparent.

The maxillæ are more elaborate, and are composed of a number of joints, and exhibit great variety in form. Attached are the maxillary palpi, which in some of the carnivorous groups are in duplicate, and it is here especially that many of the sense organs exist.

The labium closes the mouth below, and shows great development in some of the Orthoptera. It bears the labial palpi, which usually have fewer joints than the maxillary palpi. The various parts of this organ may be studied better in other orders.

Hymenoptera. — Form an intermediate step between the mandibulate and haustellate, partaking of the character of both; for, in addition to mandibles, we find a great development of the ligula or tongue. In the bees great variation of the latter is met with, forming two groups, the short and long tongued; and in the photographs now shown the details can be understood, and I would refer any one desiring a full knowledge of this interesting point to Cheshire's admirable book on bees.

Hemiptera.—This order is distinctly one of the haustellate group. The head is prolonged into a beak or rostrum composed of an elongated labrum and labium united. The mandibles are very fine and lancet-like, while the maxillæ, equally fine and closely united, appear as one organ. The rostrum is frequently very long and folded beneath the body.

Diptera.—Here we find the labrum and labium united to form a tube, and, as very great variety exists, we will select two types:—

1. Gnat. Trophi in female adapted for piercing and consisting of mandibles and maxillæ reduced to fine bristle-like organs, and which, together with the labrum, enter the wound. The labium is the largest piece, and forms a trough, in which the others lie, and which merely doubles up, but does not enter the wound when the puncture is made. In many parts of the

world these insects render the locality uninhabitable to domestic animals.

2. Blowfly. Mandibles and maxillæ suppressed, the labium being the most highly developed part. The tube in this case is much larger, and terminated by a pair of hollow sacs or labellæ, which are spread out when feeding, but at rest have their faces united. The capillary canals are deeply sunk in their surfaces till the labellæ are fully expanded, when their indented rigid edges are slightly protruded above the surface, and form the object usually labelled "teeth of a fly."

LEPIDOPTERA.—This order affords a good example of the great development of some organs and the repression of others. The most conspicuous is the familiar coiled antlia, with its large protecting palpi. Most writers regard the antlia as a development of the maxillæ, but Lowne points out that they are identical with the paraglossæ or tongue-sheaths of the bee. Each half of the antlia is pierced with two tracheal tubes, the inner margin being armed with a double row of teeth, so that when they are thus interlocked a third tube is formed, up which the nectar is pumped. The papillæ, which arm the tip of the antlia, are doubtless organs of sense. In one of the illustrations of the antlia at rest you will notice the undulating appearance of the trachea, and also the spines outside said to be used in tearing open the nectaries of flowers.

PULICIDÆ.—The most conspicuous organs in the fleas are the maxillary palpi, which exceed any of the others in size. The mandibles are finely serrated or toothed setæ, the maxillæ triangular and sheath-like, the labrum a finely perforated toothed process; while the labial palpi are partly razor-like and partly jointed in the more normal forms.

PEDICULIDÆ.—Owing to the extreme difficulty of detecting the real character of this group, they were long thought to be mandibulate in their action, but it has recently been found that the mouth-organs consist of a very easily retractile tubular labium, which is thrust out in the process of sucking. It is armed near the base with a series of hooks, and carries at the tip the representative of the mandibles.

108.—Notes on Norway.

By Henry T. Mennell, F.L.S.

(Read December 14th, 1892.)

The general features of Norway may be said to be a deeply indented coast with innumerable islets, not unlike the west coast of Scotland, but on a grander scale. The lofty cliffs rise in most places sheer from the water level to heights of 1 to 2000 ft.; above these cliffs stretch gradually rising plateaux, attaining an elevation of 4 to 5000 ft., or very rarely of 6000 ft.; vast snow-fields cover the higher parts of these plateaux, the snow-line coming down to about 5000 ft., as compared with 9 to 10,000 ft. in Switzerland.

From these snow-fields, which are comparatively level, unbroken, and monotonous, descend small glaciers, in some cases to the sea-level; but as a rule the snow-fields rarely pass out of the condition of *névé* into true glacier ice. The Folgefond in Hardanger, and the Jostedalbræ north of the Sogne fiord, are among the largest of these snow-fields, and exceed in area anything of the kind in Switzerland.

It will be readily understood from these outlines that the grandest scenery is commanded from the sea-level. The fjords or narrow arms of the sea run in some instances as much as 100 miles into the land, and thus enable steamers of deep draught to penetrate into the very heart of the country.

Next to the grandeur of the cliffs, the waterfalls are the finest feature of the country. This is due to the physical character of the land; the large plateaux and the extensive snow-fields give rise to numerous rivers, which attain their full magnitude before they precipitate themselves over the rocky rampart into the fjords. Of these falls, one of the grandest for height and volume combined is the Voringfos in Hardanger. In the Nærodal are falls attaining a height of 2000 ft., but their volume is small, and they are lost in spray ere they reach the bottom.

Geologically, the rocks consist of underlying gneiss, with granites and other primary rocks; the granites are large-grained, loosely compacted, and readily disintegrated. The peculiarity of the geology is that these primary rocks are not overlaid by sedimentary or more recent rocks.

Many theories have been advanced as to the forces which have produced the deep fissures which are now fjords. These fissures are of enormous depth; for example, in addition to the height of the cliffs above sea-level, the Sogne fiord attains a depth of 4100 ft., giving a total of 5 to 6000 ft. These fjords, however, are often much less deep at their mouths than further inland.

Ice, as a scooper out of valleys, acts in this way, scooping out a furrow not of uniform depth, and acting less powerfully and scooping less deeply as it proceeds on its course. The sharp definition of these fissures at the present day may probably be due to the fact that they have been filled up with ice from the time of their formation up to very recent times.

The climate at the present day is powerfully affected by the Gulf Stream. In latitudes uninhabitable in Eastern Siberia, the climate in Norway is mild, and the sea does not freeze. The isothermal lines run from N.W. to S.E., so that the Loffoten Islands in the North have the same January temperature as Copenhagen, and the mean temperature of the North Cape is the same (35°) as at Ostersund in Jemtland, 552 miles further south.

The rainfall on the coast is enormous, being 72 in. at Bergen, but it steadily and rapidly diminishes as we go eastward; so that at the head of the Sogne fiord it is only 23 in., or about the same as we have here.

The cultivated land in Norway is of very limited extent, being only 1074 square miles. Owing to the long Arctic days, barley ripens in the same number of days from the time of sowing (90 days), as in the South of France.

The botanical features of the country have close affinity to those of Scotland, or we should say, more correctly, the flora of Scotland is distinctly Scandinavian. It is for this reason that the Norwegian flora is of much interest to the English botanist; but the flora, which only survives on the higher mountains of Scotland, and the species which are of the greatest rarity there, in Norway prevail down to the sea-level, and in great profusion. Ericaceous plants, or plants of the heath tribe, are perhaps the most striking features of this flora; *Menziesia* (2 species), *Andromeda*, *Vaccinium* (5 species), including the beautiful cranberry, and our ordinary heaths, abound and are of great beauty. In this respect there is much resemblance to the swamp flora of the central regions of Canada, and the geological record is also much the same—primary (Laurentian) rocks, uncovered by stratified rocks. *Saxifraga oppositifolia*, *S. aizoides*, *Silene acaulis*, *Lychnis viscaria*, *Aster alpinus*—and, among ferns, *Asplenium septentrionale* and *Woodsia*—all British rarities, abound, and are of great beauty. *Ranunculus glacialis* and *aconitifolius*, *Aconitum alpinum* (monkshood), *Saxifraga cotyledon* (with its fine feathery spikes of delicate white flowers), *Silene rupestris*, are among the more striking alpines which are not British.

In the woods, at not very high elevations, the lovely creeping *Linnæa borealis*, *Cornus suecica*, *Trientalis europæa*, and *Pyrola grandiflora* are in the utmost profusion, and must attract the admiration of all, whether botanists or not, by their beauty.

The forests disappointed us. In Western-Central Norway, of which alone we can speak, the pines and other trees are comparatively small.

The traces of ice action in all parts of the country are very remarkable. Moraines, both terminal and lateral, are distinctly traceable in most of the valleys; scratched rocks and perched blocks are everywhere noticeable.

We saw much fewer birds than we anticipated. The fieldfare was everywhere abundant and noisy; we found its nest near Eide. Mergansers were plentiful on the fjords, but there were comparatively few water-fowl upon them. Ravens were seen and heard occasionally, but no large birds of prey. These must be looked for further north, as in the Romsdal.

The waters abound with fish, and any one who cannot eat it freely will fare badly in Norway. Salmon three times a day is the rule, varied with excellent whiting from the fjords. Bergen has probably the largest fish market in the world, and it is a sight of great interest. Large quantities of fish are brought to market alive in coffin-shaped boxes towed behind the boats; from these the fish are transferred to long ranges of tanks on the quays surrounding the harbour, and are sold alive to the people.

109.—REPORT OF THE METEOROLOGICAL SUB-COMMITTEE FOR 1892.

PREPARED BY THE HON. SEC. FRANCIS CAMPBELL BAYARD, F. R. Met. Soc.

THE arrangements for observing the daily rainfall round Croydon have been successfully carried out on the same plan as heretofore. As this is the Fifth Annual Report of the Sub-Committee, it seems desirable briefly to look back to previous years, and see whether we are making progress. The first Report contained 34 records sent in by 31 observers, whilst the present one contains 54 records contributed by a staff numbering 46 observers. So much for its popularity. With respect to its usefulness, the Hon. Sec. has been applied to by various public bodies, as well as private individuals, for information and returns, which would appear to show that this publication of the Club is supplying a want.

During the course of the year three stations have disappeared, namely, Lovelands (Reigate Hill), through the removal of the observer, Mr. Binns; The Wrythe (Carshalton), through the death of the observer, Mr. Manley; and Shooter's Hill (Woolwich), owing to the gauge being stolen, and the refusal of Major May, the observer, to replace it. Mr. Snell, of The Chestnuts, Chislehurst, having moved into Bromley, where he has established a station, discontinued his station at Chislehurst at the end of the year, having obligingly kept it on for some months in order to avoid a break.

Appendix I. to this Report contains a list of the observers, with particulars relating to the stations and gauges. The two stations with the asterisk prefixed were admitted after the commencement of the year, and the two with the double asterisks are stations which sent in reports in the previous year.

Appendix II. contains the tables of daily rainfall issued monthly, and subsequently stereotyped.

Appendix III. gives the monthly rainfall of four other stations.

Appendix IV. gives a record of all falls of rain of 1 in. and upwards in the 24 hours, extracted from Appendix II. and other sources.

And, finally, Appendix V. contains general notes on the characteristic features of every month.

The Sub-Committee report with great pleasure the accession of stations at Westerham, Coulsdon, and Eltham, the first of which is especially welcome, as filling a great gap in a part of the Club's district which is entirely unrepresented in our daily returns. For this station, as well as for Eltham, the Sub-

Committee is indebted to Mr. Morris, the engineer of the Kent Waterworks Company.

With respect to the rainfall of the year, the smallness of the fall during the first seven months is especially noticeable. At Greenwich the fall was only 10·04 in., whilst the mean for the first seven months of the 50 years' (1841–90) average is 15·10 in.; at Surbiton the seven months' fall was only 8·78 in., whereas the 35 years' (1856–90) average is 13·28 in.; at Brixton the seven months' fall was only 9·73 in., whereas the 20 years' (1871–90) average is 13·65 in.; at Addiscombe (Outram Road) the seven months' fall was only 11·52 in., whereas the 15 years' (1876–90) average is 14·07 in.; and at Waddon the seven months' fall was only 10·55 in., whereas the 10 years' (1881–90) average is 12·92 in. These examples show the very serious deficiency which occurred during the first seven months, the deficiency being greater in the case of those places which have the longest average. This curious fact gives rise to a question which the Sub-Committee can only propound without, owing to the want of sufficient material, making any attempt to solve, *viz.*, the question whether the rainfall of the first seven months does not show signs of diminishing in amount? This question is well worth very serious consideration, but at present your Sub-Committee can offer no definite reply. The Sub-Committee think that practically at the end of the first seven months there was a deficiency in the rainfall of between 3 in. and 4 in., certainly a very large amount.

The last five months of the year offer a striking contrast to the first seven months, for the rainfall was in every case above the average. At Greenwich the total of the last five months was 12·31 in., the 50 years' average for the same months being 11·44 in.; at Surbiton the fall for the last five months was 12·39 in., the 35 years' average being 11·31 in.; at Brixton it was 13·27 in., whilst the 20 years' average was 11·46 in.; at Addiscombe (Outram Road) it was 13·30 in., whilst the 15 years' average was 12·34 in.; and at Waddon it was 12·50 in., whilst the 10 years' average was 10·73 in. It would thus appear that over the district the excess of the last five months would be about 1 in.

With respect to the deficiency in the annual fall as compared with the average, it would be between 2 in. and 3 in. in the Club's district. This great deficiency will not, however, produce any very serious effects on our water supply, for, as shown above, the deficiency occurred in the early part of the year, when evaporation is very active, and very little of the rain that falls can replenish our underground stores of water, whilst the heavy rains of the latter part of the year have been of essential use in adding to our stores; so that there is no likelihood of a deficiency during the present year.

The Sub-Committee would draw attention to the rather large number of days on which 1 in. and upwards fell in the 24 hours, and to the great area of these falls. At only three places are the falls at all noticeable as being over 2 in., *viz.*, in the fall on the 28th June, when there fell at Caterham Valley 2·50 in., at Caterham 2·45 in., and at Marden Park 2·12 in. in the 24 hours.

In conclusion, the Sub-Committee express the hope that in the course of the present year they may be able to replace the loss of the Reigate Hill station, and they also have hopes of getting a station at Cobham; but at present they see no hopes of one at Erith. The Sub-Committee desire to express their thanks to those gentlemen who so kindly subscribed the amount necessary to enable this great work to be carried on, and also to all the observers for their co-operation in forwarding their returns.

APPENDIX I.

No.	Stations.	Observers.	Size of Gauge.	Height of Gauge above Ground.		Height of Gauge above Sea-level.
			IN.	FT.	IN.	FT.
	SURREY—					
	Dorking (Denbies)	J. Beesley	5	0	6	610
	Caterham (Metropolitan Asylum)	G. S. Elliott, M.D.	5	1	0	610
	Caterham Valley (The College)	C. W. Rudd; Miss S. W. Rudd	5	1	0	500
	KENT—					
	**Knockholt (The Beeches)	W. Morris, C.E.	5	1	0	785
	SURREY—					
5	Marden Park (Birchwood House)	C. & F. Rutley	5	1	0	471
	Kenley (Ingleside)	Harold Smith	8	1	0	375
	*Coulsdon (The Grange)	W. J. Stride	5	1	4	525
	Purley (Reedham Asylum)	J. A. Carter	5	1	0	375
	Purley (Tudor Cottages)	J. Bonwick	5	1	0	216
10	Ashtead (D'Abernon Chase)	Sir W. Vincent, Bart.	5	1	0	280
	Oxshott	W. H. Dines	5	1	0	212
	Banstead (The Larches)	Rev. C. J. Taylor	8	1	0	488
	Sutton (Mulgrave Road)	W. Goode	5	5	6	230
	Carshalton (The Wrythe)	The late J. W. Manley	5	4	10	107
15	Wallington (Manor Road)	F. Campbell Bayard	5	4	1	157
	Beddington (Riverside)	S. Rostron	5	1	0	120
	Waddon (Waddon House)	P. Crowley	5	1	0	156
	Croydon (Brimstone Barn)	Croydon Corporation	5	1	0	130
	*Croydon (Waddon New Road)	Croydon Corporation	5	1	0	146
20	**Croydon (Oakfield Road)	A. Malden	5	1	6	178
	Croydon (Whitgift School)	A. E. Watson	5	1	0	191
	Addiscombe (Havelock Road)	Baldwin Latham, C.E.	8	1	0	205
	Addiscombe (Outram Road)	E. Mawley	8	0	9	202
	Addington Hills (The Reservoir)	Croydon Corporation	8	0	9	473
25	Addington (Park Farm)	W. Whalley	5	1	0	268
	Addington (Pumping Station)	Croydon Corporation	8	1	0	331
	KENT—					
	West Wickham (Layham's Farm)	W. Ashcroft	5	1	0	500
	Hayes Common (The Warren)	Miss Akers	5	1	0	296
	Keston (Bradfield)	A. Hill	5	1	0	350
30	Keston (Heathfield)	Miss M. Holland	5	0	6	420
	Keston (Tower Fields)	G. Buchanan, C.E.	8	0	9	351
	Orpington (Kent Waterworks)	W. Morris, C.E.	5	1	0	220
	Farningham Hill	A. J. Waring	5	3	0	300
	Wilmington (Kent Waterworks)	W. Morris, C.E.	5	1	0	25
35	Chislehurst (The Chestnuts)	J. B. Snell	5	1	0	325
	Bickley (Highfield)	J. Batten	5	1	2	295
	Beckenham (Foxgrove)	P. Bicknell	5	0	6	142
	SURREY—					
	South Norwood (Selhurst Road)	B. N. Dalton, M.D.	5	1	0	210
	Wimbledon (Sewerage Works)	C. H. Cooper, C.E.	5	1	0	58
40	Wimbledon (Mount Ararat)	T. Devas	12	3	0	157
	Raynes Park (Pumping Station)	C. H. Cooper, C.E.	5	1	0	47
	New Malden (Sewerage Works)	T. V. H. Davison, C.E.	5	1	0	45
	Esher (Sewerage Works)	Baldwin Latham, C.E.	5	1	0	40
	Surbiton (Seething Wells)	R. Hack, C.E.	10	0	6	25
45	Kingston (Sewerage Works)	T. Stevens	5	1	0	25
	Richmond (Ormond Lodge)	J. T. Billett	5	0	9	51
	Brixton (Acre Lane)	F. Gaster	8	1	0	77
	Wandsworth Common (Patten Rd.)	F. J. Brodie	5	1	0	100
	West Norwood (Thornlaw Road)	W. Marriott	8	1	0	220
	KENT—					
50	Forest Hill (Dartmouth Road)	Mrs. Behrens	5	1	0	220
	Forest Hill (The Nurseries)	James Carter & Co.	6	0	6	76
	Deptford (Kent Waterworks)	W. Morris, C.E.	5	1	0	20
	Greenwich (Royal Observatory)	The Astronomer Royal	8	0	5	155
	Woolwich (Shooter's Hill)	Major E. S. May, R.A.	5	1	0	352

APPENDIX II.

Daily Rainfall. **January, 1892.**

Day of Month	Dorking	Caterham	Caterham Valley	Marden Park	Kenley	Purley (Reedham)	Purley (Tudor C.)	Ashtead	Oxshott	Banstead	Sutton	Carshalton
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	..	..	..	..	..	..	..	..	..	..	..
2	..	..	..	..	·01	..	..	·03	..	·01	..	..
3	..	..	..	..	..	..	..	..	..	..	..	..
4	..	..	..	..	..	..	..	..	..	..	..	..
5	·04	..	·02	..	·01	..	..	..	·01	..	..	·01
6	·16	·11	·11	·09	·02	·14	·12	·11	·13	·12	·10	·08
7	·02	·05	..	·01	·01	..	..	·02	·01	..	..	..
8	·02	·02	..	·03	·01	..	·01	·02	·01	·01	..	..
9	·02	..	..	..	..	..	·01	·05	..	..	..	..
10	·02	..	·03	·01	·01	·02	·02	..	·01	..	..	..
11	..	..	..	·02	..	·02	..	..	·01	..	..	..
12	..	..	·05	..	..	..	..	..	..	..	..	..
13	..	..	..	..	..	·08	..	..	..	..	..	..
14	..	..	..	..	..	..	..	..	..	..	..	..
15	..	..	..	..	..	..	..	..	..	..	..	..
16	·23	..	·09	·07	·24	..	..	·06	·07	·04	·08	..
17	·03	..	·02	·02	..	..	·05	·03	·01	·09	·04	·06
18	..	..	..	·01	..	..	..	·02	..	..	..	..
19	·02	..	..	·01	..	..	..	..	..	..	..	·03
20	..	..	..	·01	..	..	..	..	..	..	..	..
21	·02	·02	..	·01	·01	·01	·09	·02	·02	·02	·03	·01
22	·11	·08	·13	·08	·09	·06	·10	·08	·07	·07	·09	·09
23	·05	·07	..	·04	·04	·05	·06	·04	·03	·03	·04	·03
24	..	..	·06	..	..	..	..	·03	..	..	..	..
25	..	..	..	..	..	..	..	..	..	..	..	..
26	..	..	·02	·01	·02	..	..	·02	..	..	·01	·01
27	·10	..	..	..	·08	·07	·07	·06	·07	·03	·05	·04
28	..	..	·05	..	..	..	..	..	..	..	..	·01
29	..	..	..	..	..	·05	..	..	..	·05	..	..
30	·09	·12	..	·10	·06	·01	·04	..	·01	·04	·03	·06
31	..	·03	·04	·02	·02	..	·03	·06	·05	·02	·03	..
Total	·93	·50	·62	·54	·63	·51	·60	·65	·51	·53	·50	·43
From Jan.1	·93	·50	·62	·54	·63	·51	·60	·65	·51	·53	·50	·43

Day of Month	Wallington	Bedding-ton	Waddon	Croydon (Brim. Bn.)	Croydon (Whitgift)	Addiscmb. (Hvlk. Rd.)	Addiscmb. (Outm.Rd.)	Addington Hills	Addington (Park Fm.)	Addington (Pump. St.)	West Wickham	Hayes Common	Keston (Bradfield)
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	..	..	..	..	..	..	..	·01	..	..	·01	..
2	..	..	..	..	..	·01	·01	·02	..	·01	..	·01	..
3	..	..	..	..	..	..	..	..	..	..	..	..	..
4	..	..	..	..	..	..	..	..	..	..	..	..	..
5	·01	·01	·02	·02	..	..	..	..	·01	..	..	..	..
6	·09	·10	·12	·12	·12	·15	·12	·14	·15	·15	·07	·13	·12
7	..	·01	·02	..	·03	..	·01	..	·01	..	..	·02	·01
8	..	..	..	..	..	·01	..	..	·01	·01	..	..	·01
9	..	..	..	..	..	..	..	..	·01	..	..	·01	..
10	..	..	·02	..	·02	·01	·01	..	..	·02	..	..	·01
11	·01	..	..	..	·02	·01	·01	·03	·01	..	..	..	·01
12	..	..	..	..	..	..	..	..	·01	..	..	·01	..
13	·01	·01	..	..	·02	·01	·02	..	·03	..	..	·02	·01
14	..	..	..	..	..	..	..	..	..	..	..	..	..
15	..	..	..	..	..	..	..	..	..	..	..	..	..
16	·03	·01	·05	..	·04	·01	·04	·08	·06	·05	·04	·06	·06
17	·01	·01	·03	..	·02	..	..	..	..	·01	..	·01	..
18	..	·02	..	..	..	..	..	..	..	..	..	..	..
19	·01	..	..	..	·03	..	·02	·01	·01	·01	·07	·01	·01
20	..	..	..	..	..	..	..	..	..	..	..	..	..
21	..	·02	..	..	..	·03	..	..	..	..	..	..	..
22	·08	·12	·09	·12	·09	·10	·10	·06	·10	·08	·08	·09	·07
23	·04	·05	·05	·05	·05	·07	·05	·04	·01	·03	·03	·04	·03
24	·01	..	..	..	..	..	..	..	·06	·01	..	..	..
25	..	..	..	..	..	..	..	..	·02	..	..	·01	..
26	·01	..	·01	..	·01	·02	·01	·04	·01	·01	·01	·01	·02
27	·05	·05	·04	·04	·05	·06	·05	·06	·05	·05	·05	·04	·04
28	..	..	..	..	..	..	..	..	·01	..	..	·01	..
29	..	..	..	..	..	..	..	..	..	..	..	..	..
30	·03	·03	·03	..	·06	·04	·05	·05	·04	·03	·07	·05	·03
31	·05	·04	·04	·06	..	·03	·02	·02	·03	·02	..	·02	·01
Total	·44	·48	·52	·41	·56	·56	·52	·55	·65	·49	·42	·56	·44
From Jan.1	·44	·48	·52	·41	·56	·56	·52	·55	·65	·49	·42	·56	·44

Daily Rainfall. **January, 1892.**

Day of Month	Keston (Heathfld.)	Keston (Tow. Fds.)	Orpington	Farningham Hill	Wilmington	Chislehurst	Bickley	Beckenham	South Norwood	Wimbledon (Sew. Wks.)	Wimbledon (Mt. Ararat)	Raynes Park	New Malden
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	..	·02	..	..	·01	..	..	..	..	..	..	..
2	..	·01	..	..	..	..	..	..	..	..	..	·02	..
3	..	..	..	..	..	·01	..	·01	..	..	..	..	..
4	..	..	..	..	..	..	..	..	..	..	..	..	..
5	·02	..	..	·01	..	..	..	..	..	..	·01	·02	..
6	·11	·13	·03	·08	·14	·07	·04	·09	·03	·16	·06	·07	·06
7	·02	·02	..	·01	·03	·02	..	..	..	·01	..	·02	·02
8	·03	·02	..	·01	·01	·01	..	..	..	·01	..	·02	·02
9	..	..	..	..	..	..	..	..	..	..	·02	..	..
10	..	·01	·01	·01	..	·03	·02	..	·02	·01	..	·01	..
11	·02	·01	..	·01	..	·02	·03	·02	·11	·02	..	·02	·02
12	..	..	..	..	..	..	..	..	·01	..	..	..	..
13	·02	..	..	·02	..	·02	·03	..	..	..	..	..	..
14	..	..	..	..	..	..	..	..	..	·01	..	·01	..
15	..	..	..	..	..	..	..	..	..	·01	..	..	..
16	·01	·02	·07	·03	·01	·03	·03	·01	..	·01	..	·03	..
17	·07	·07	..	..	..	·01	·01	..	·04	..	..	..	..
18	..	..	..	·01	..	..	..	..	..	..	..	..	..
19	..	..	..	..	..	..	·03	·01	·01	·01	..	·01	..
20	..	..	..	..	..	..	..	..	..	·01	..	..	..
21	..	·02	·01	..	..	..	..	..	..	..	..	·01	..
22	·08	·09	..	·06	·07	·11	·03	·10	·12	·01	..	·09	·05
23	·04	·05	..	·03	·07	·05	·09	·05	·02	·04	·02	·03	..
24	..	..	..	..	..	·01	..	..	..	..	..	·01	·02
25	..	..	..	..	..	..	..	..	..	..	..	..	..
26	·01	·02	..	·02	..	·01	·03	·01	·01	·02	..	·02	·01
27	·06	·05	·03	·04	·03	·05	·04	·04	·04	·04	·07	·06	·03
28	..	..	..	..	·03	·01	..	..	..	..	..	·01	..
29	..	..	..	..	..	..	..	..	..	..	..	..	..
30	·05	·03	·02	·05	·01	·10	·11	·10	·06	·05	·09	·04	..
31	·03	·06	..	..	..	·02	·02	·02	·01	·03	..	·06	·02
Total	·57	·61	·19	·39	·40	·59	·51	·46	·48	·45	·27	·56	·25
From Jan. 1	·57	·61	·19	·39	·40	·59	·51	·46	·48	·45	·27	·56	·25

Day of Month	Esher	Surbiton	Kingston	Richmond	Brixton	Wandswth. Common	West Norwood	Forest Hill Dartmh. rd.	Forest Hill (Nurseries)	Deptford	Greenwich	Woolwich
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	..	..	..	..	..	..	..	..	..	..	..
2	..	..	..	..	..	..	..	..	..	·01	..	..
3	..	..	..	..	·02	..	..	·06	·03	..	·01	..
4	..	..	..	..	..	..	..	..	..	..	..	..
5	..	..	..	·02	..	·01	..	..	..	..	·01	..
6	·07	·08	·11	·06	·09	·09	·08	·04	·09	·08	·07	·10
7	·01	·01	·03	·02	·01	·02	..	·03	..	·01	..	..
8	·03	·02	·03	·03	·01	·02	..	..	..	..	..	..
9	..	..	..	..	..	..	..	..	..	..	..	..
10	·02	..	·01	·01	..	..	..	..	..	..	·01	·02
11	..	..	·02	·02	·02	·03	·02	..	..	..	·01	..
12	..	..	..	·01	..	·01	..	..	..	..	..	..
13	..	..	·01	..	..	..	..	..	..	..	..	..
14	..	..	..	..	·02	·01	..	..	..	..	..	..
15	..	..	..	..	..	..	..	..	..	..	..	..
16	·01	..	·01	·03	·01	·02	·01	..	..	..	·01	·03
17	..	..	..	..	..	..	..	..	..	..	..	..
18	..	..	..	..	..	..	..	..	..	..	..	..
19	·01	..	..	..	..	·02	·02	·02	..	..	·01	..
20	..	..	..	..	..	..	..	..	..	..	..	..
21	..	..	·01	·02	·01	·01	..	..	..	..	..	..
22	·03	·07	·07	·08	·07	·09	·14	·15	·16	·09	·09	·10
23	·02	..	·02	·03	·06	·04	·04	·05	·08	·04	·03	·03
24	..	..	..	..	..	..	..	..	..	..	..	..
25	..	..	..	..	..	..	..	..	..	..	..	..
26	..	..	·02	·02	·01	·02	·01	·02	..	·01	·01	·01
27	·04	·04	·06	·05	·07	·07	·05	·07	·08	·06	·08	·06
28	..	..	..	..	..	·01	·01	..	..	..	..	..
29	..	..	..	..	..	..	..	..	..	..	..	..
30	·02	..	·04	·08	·06	·09	·06	·10	·10	·04	·04	·04
31	·03	·05	·01	·02	·04	·01	·02	·02	·01	..	..	..
Total	·29	·27	·45	·50	·50	·57	·46	·56	·55	·34	·38	·38
From Jan. 1	·29	·27	·45	·50	·50	·57	·46	·56	·55	·34	·38	·38

Daily Rainfall. **February, 1892.**

Day of Month	Dorking	Caterham	Caterham Valley	Marden Park	Kenley	Purley (Reedham)	Purley (Tudor C.)	Ashtead	Oxshott	Banstead	Sutton	Carshalton	Wallington
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	·11	·02	·07	·09	·09	·07	·09	·11	·09	·12	·15	·12
2	·03	..	·06	·04	·05	·06	·05	·06	·05	·05	·06	·10	·08
3	..	..	..	..	..	..	..	..	..	..	..	..	..
4	·02	·04	·03	·03	·02	..	·02	..	..	·01	..	·03	·02
5	..	..	..	..	..	..	..	..	..	..	..	..	..
6	·05	·06	·06	·08	·09	..	·06	·04	·04	·03	·07	·07	·08
7	·06	·07	·09	·05	·08	·15	·07	·04	·03	·06	·06	·07	·05
8	·14	..	·14	·16	·16	·15	·17	·06	·12	·09	·07	·08	·13
9	·03	·10	·04	·04	·04	·03	·05	·03	·02	·02	·03	·03	·03
10	..	..	·01	·01	..	..	·02	..	..	..	..	..	..
11	..	..	..	..	·01	..	..	..	·01	..	..	·01	..
12	..	..	..	..	..	..	..	..	..	..	..	..	..
13	..	..	..	..	..	..	..	..	..	..	..	..	..
14	·16	..	·09	·10	·13	·12	·11	·13	·12	·12	·11	·11	·11
15	·14	·25	·04	·06	·05	·10	·04	·03	·03	·21	·04	·06	·07
16	..	..	..	..	·01	..	..	..	..	..	·08	..	..
17	·13	·15	·10	·12	·12	·08	·07	·03	·03	..	·03	·04	·05
18	..	..	..	..	..	..	·09	·06	..	..	..	..	..
19	..	·07	·07	·07	·03	·07	·03	..	·03	·12	..	·04	·06
20	·25	·31	·32	·34	·45	·39	·40	·34	·25	·30	·36	·31	·35
21	·03	..	·06	·08	·06	..	..	·03	·02	·02	·08	·02	·03
22	..	·07	·02	·01	·01	·13	·08	..	..	..	..	..	..
23	·10	..	·10	·18	·12	·15	·11	·07	·13	·10	·14	·23	·13
24	·07	..	..	·06	·19	..	·16	·14	·09	·11	·12	·04	·13
25	..	..	..	..	·01	..	·02	..	..	..	..	·01	·01
26	..	..	..	·02	·02	·01	..	..	..	..	·01	..	·01
27	..	..	..	..	..	..	·03	..	..	..	..	·01	..
28	..	·03	..	..	..	·02	..	..	·01	..	·02	..	..
29	..	·07	·09	·03	·07	·07	·07	·05	·04	·07	·10	·10	·07
Total	1·21	1·33	1·34	1·55	1·81	1·62	1·72	1·20	1·12	1·40	1·50	1·51	1·53
From Jan. 1	2·14	1·83	1·96	2·09	2·44	2·13	2·32	1·85	1·63	1·93	2·00	1·94	1·97

Day of Month	Bedding-ton	Waddon	Croydon (Brim. Bn.)	Croydon (Whitgift)	Addiscmb. (Hvlk. Rd.)	Addiscmb. (Outm. Rd.)	Addington Hills	Addington (Park Fm.)	Addington (Pump. St.)	West Wickham	Hayes Common	Keston (Bradfield)
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·14	·15	·15	·17	·16	·15	·10	·12	·11	·07	·09	·08
2	·09	·09	·09	·08	·09	·09	·06	·07	·03	·03	·08	·05
3	..	..	..	..	..	..	..	..	..	..	..	..
4	·03	·03	..	·02	·02	·02	·04	·03	..	·04	·02	·02
5	..	..	..	..	..	..	..	..	·04	..	..	..
6	·08	·08	·10	·08	·09	·08	·09	·09	·09	·08	·06	·07
7	·07	·07	·06	·06	·08	·06	·07	·01	·06	·04	·07	·05
8	·09	·07	·06	·11	·06	·08	·08	·13	·09	·10	·08	·08
9	·03	·03	·04	·04	·06	·05	·06	·05	·05	·04	·04	·04
10	..	..	..	..	..	..	..	..	..	·01	..	·01
11	..	..	..	..	..	..	·01	·01	·01	..	..	..
12	..	..	..	..	..	..	..	..	..	..	·02	·01
13	..	..	..	..	..	..	..	·01	..	..	·01	..
14	·11	·10	·10	·10	·11	·11	·12	·12	·13	·14	·09	·10
15	·09	·03	·07	·04	·03	·06	..	·06	·01	·03	·03	·06
16	..	..	..	·04	..	..	..	·01	..	·01	..	·02
17	·08	·03	·06	·12	·07	·08	·04	·08	·09	·07	·06	·07
18	..	..	..	..	..	..	..	..	..	..	..	·01
19	·06	·04	·06	·08	·05	·07	·10	·09	·07	·07	·08	·02
20	·37	·36	·13	·38	·45	·43	·43	·53	·45	·49	·54	·52
21	·03	·05	·04	·10	·06	·06	·07	·06	·07	·05	·05	·05
22	..	..	..	..	..	..	..	·01	..	..	..	..
23	·13	·16	·15	·15	·15	·13	·13	·03	·12	·10	·14	·12
24	·11	·10	·11	·11	·10	·12	·16	·32	·11	·13	·10	·11
25	..	·02	..	..	..	..	..	·01	..	..	·01	..
26	..	..	..	..	·01	·01	·01	..	·01	·02	·01	·01
27	..	..	..	..	..	..	..	..	..	..	..	..
28	·01	..	..	·01	..	..	..	..	..	..	..	..
29	·06	·09	·10	·08	·09	·07	·05	·02	·02	·04	·02	·04
Total	1·58	1·50	1·32	1·77	1·66	1·67	1·62	1·86	1·56	1·56	1·60	1·61
From Jan. 1	2·06	2·02	1·73	2·33	2·22	2·19	2·17	2·51	2·05	1·98	2·16	2·05

Day of Month	Keston (Heathfld.)	Keston (Tow. Fds.)	Orpington	Farning-ham Hill	Wilming-ton	Chislehurst	Bickley	Beckenham	South Norwood	Wimbledon (Sew. Wks.)	Wimbledon (Mt. Ararat)	Raynes Park	New Malden	Esher	Surbiton	Kingston	Richmond	Brixton	Wandswth. Common	West Norwood	Forest Hill Dartmh. rd.	Forest Hill (Nurseries)	Deptford	Greenwich	Woolwich
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·10	·12	·01	·06	·02	·10	·10	·09	·14	·10	·08	·08	·05	·11	·10	·07	·09	·11	·13	·10	·10	·12	·09	·11	·01
2	·05	·08	·12	·06	·07	·08	·09	·08	·12	·12	·12	·12	·07	·06	·09	·12	·10	·11	·11	·10	·11	·12	·11	·10	·04
3	..	·06	·01	..	·02	·01	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	..
4	·03	·02	..	·01	..	·01	..	..	·01	..	·02	·03	·03	·01	·01	·05	..	..	·01	..	..	·01	..	·01	..
5	..	·01	..	..	..	..	..	..	..	·01	..	..	..	..	..	..	·02	..	..	..	..	..	..	..	..
6	·08	·06	..	·03	·02	·04	·04	·05	·08	·08	..	·08	·04	·03	·03	·05	·06	·06	·07	·05	·04	·04	·02	·04	·03
7	·07	·04	·05	·04	·06	·06	·06	·06	·08	·06	·12	·07	·05	·05	·05	·08	·05	·02	·05	·05	·12	·02	·04	·05	·06
8	·08	·12	·10	·05	·03	·08	·11	·06	·07	·09	·12	·14	·05	·04	·06	·06	·12	·09	·07	·08	·19	·13	·08	·07	·02
9	·05	·05	..	·04	·09	·06	·06	·04	·06	·03	·03	·03	·02	·02	..	·03	·03	·04	·03	·05	·04	·04	·03	·04	·03
10	..	·10	..	..	..	·01	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
11	·01	..	..	·01	..	..	·02	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..
12	..	·01	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	·01	..
13	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·05	..	..	..	..
14	·11	·09	·02	·05	·02	·09	·10	·10	·11	·13	·12	·13	·10	·07	·11	·11	·14	·13	·11	·12	·08	·12	·08	·10	·10
15	·09	·08	..	·02	·03	·09	·14	·07	·01	·11	·12	·14	·09	·01	·08	·16	·20	·08	·12	·04	..	..	·21	·24	·16
16	·02	·01	..	..	..	·01	·01	..	·07	..	..	·02	..	..	..	..	..	..	·01	..	·06	·05	..	..	..
17	·13	·11	..	·14	·03	·09	·10	·09	·07	·08	..	·07	·02	·05	·08	·08	·10	·10	·08	·09	·12	..	·06	·09	·02
18	..	..	..	..	..	..	..	..	·01	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..
19	·10	·10	..	·08	·09	·08	·10	·05	·09	·07	·05	·05	..	·02	·03	·03	·02	·06	·07	·07	·08	·07	·06	·09	·01
20	·51	·49	·67	·50	·38	·39	·43	·34	·39	·19	·18	·20	·16	·17	·16	·18	·18	·28	·18	·26	·39	·43	·30	·38	·46
21	·06	·06	·02	·07	·09	·06	·06	·05	·05	·01	..	·12	·02	·01	..	..	..	·04	·02	·05	·08	·08	·05	·07	·05
22	..	..	..	·18	..	·01	·02	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·02	..	..	·01
23	·14	·12	·08	·03	·19	·16	·17	·12	·20	·15	·10	·15	·03	·12	·10	·19	·15	·08	·14	·11	·09	·04	·14	·16	·22
24	·07	·15	..	..	·07	·10	·10	·10	·06	·12	·19	·16	·25	·10	·11	·12	·12	·18	·12	·16	·17	·22	·10	·12	·01
25	..	..	..	..	..	..	·01	..	·01	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	..
26	·02	·02	..	·01	..	·01	·02	..	·01	..	..	..	..	..	..	..	..	..	..	..	·02	·01	..	..	·01
27	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
28	..	..	..	..	..	..	..	..	..	·03	..	·02	..	..	..	..	·02	..	·02	..	..	..	..	..	..
29	·03	·03	..	·05	·03	·02	·03	·03	·10	·01	·08	·08	·03	·02	·03	·08	·02	·07	·07	·09	·03	·04	·04	·06	·02
Total	1·75	1·93	1·08	1·43	1·23	1·56	1·78	1·34	1·74	1·39	1·34	1·70	1·01	·89	1·04	1·41	1·42	1·45	1·43	1·42	1·77	1·57	1·41	1·74	1·26
From Jan. 1	2·32	2·54	1·27	1·82	1·63	2·15	2·29	1·80	2·22	1·84	1·61	2·26	1·26	1·18	1·31	1·86	1·92	1·95	2·00	1·88	2·33	2·12	1·75	2·12	1·64

Daily Rainfall. **March, 1892.**

Day of Month	Dorking	Caterham	Caterham Valley	Marden Park	Kenley	Purley (Reedham)	Purley (Tudor C.)	Ashtead	Oxshott	Banstead	Sutton	Carshalton
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·33	·04	·11	·18	·07	·16	·08	..	·08	·20	·08	·14
2	..	·07	·06	..	·02	..	·11	..	..	..	·03	..
3	..	·11	·05	·01	·01	..	·04	..	..	..	·01	·01
4	..	..	..	..	·01	..	..	..	..	..	..	..
5	..	..	..	..	..	..	..	..	..	..	..	..
6	..	..	..	..	..	..	..	..	..	..	..	..
7	..	..	..	..	..	..	..	..	..	..	..	..
8	..	..	..	..	..	..	..	..	..	..	..	..
9	·08	·15	·15	·10	·13	·11	·10	..	·09	·09	·10	·14
10	·07	..	·02	·01	·01	·01	..	..	·10	·03	·01	·01
11	..	..	..	..	..	..	..	..	..	..	..	..
12	..	..	..	..	..	..	..	..	..	..	..	..
13	..	..	..	..	·02	..	..	..	..	..	..	..
14	..	..	..	..	..	·01	..	..	..	..	..	..
15	·77	·45	·36	·61	·73	·65	·78	·75	·44	·70	·77	·75
16	..	..	·02	·01	·02	..	..	·01	·01	..	..	..
17	..	..	..	..	..	..	..	..	..	..	..	..
18	..	..	..	..	..	..	..	..	..	..	..	..
19	..	..	..	..	..	..	..	..	..	..	..	..
20	..	..	..	..	..	..	..	..	..	..	..	..
21	·11	·11	·09	·12	·13	·16	·12	·14	·14	·09	·13	·12
22	·15	·20	·25	·24	·14	·16	·17	·14	·14	·14	·12	·12
23	..	..	..	·01	·01	..	·02	..	..	..	..	·01
24	..	..	..	..	..	..	..	..	..	..	..	..
25	..	..	..	..	..	..	..	..	..	..	..	..
26	·09	·24	·20	·21	·15	·13	..	·14	·14	·08	·10	·10
27	·05	·07	·06	·04	·05	·08	·19	·06	·07	·05	·07	·08
28	..	..	..	..	·01	..	..	..	..	·03	..	..
29	..	..	..	..	..	..	..	..	..	..	..	..
30	..	..	..	..	..	..	..	..	..	..	..	..
31	..	..	..	..	..	..	..	..	..	..	..	..
Total	1·65	1·44	1·37	1·54	1·51	1·47	1·61	1·24	1·21	1·41	1·42	1·48
From Jan. 1	3·79	3·27	3·33	3·63	3·95	3·60	3·93	3·09	2·84	3·34	3·42	3·42

Day of Month	Wallington	Beddington	Waddon	Croydon (Brim. Bn.)	Croydon (Whitgift)	Addiscmb. (Hvlk. Rd.)	Addiscmb. (Outm. Rd.)	Addington Hills	Addington (Park Fm.)	Addington (Pump. St.)	West Wickham	Hayes Common	Keston (Bradfield)
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·16	·15	·11	·15	·11	·13	·16	·09	·15	·01	·15	·15	·20
2	·01	..	..	..	·03	..	·01	..	·03	·03	·01	..	·01
3	..	..	..	..	·01	·01	..	..	..	..	..	·02	·01
4	..	..	..	..	·03	..	..	..	·01	..	..	..	·01
5	..	..	..	..	·02	..	..	..	..	..	..	·02	..
6	..	..	..	..	..	..	..	..	..	..	..	..	..
7	..	..	..	..	..	..	..	..	..	..	..	..	..
8	..	..	..	..	..	..	..	..	..	..	..	..	..
9	·15	·11	·15	·14	·15	·18	·19	·07	·15	·13	·13	·04	·14
10	·01	·06	·02	..	·05	..	·01	..	·02	..	·01	·01	..
11	..	..	..	..	..	..	..	..	·01	..	..	·16	·01
12	..	..	..	..	..	..	..	..	..	·02	..	..	·01
13	..	..	..	..	..	..	..	..	..	..	..	..	..
14	..	..	..	..	..	..	..	..	..	..	..	..	..
15	·72	·72	·65	·52	·71	·74	·76	·68	·80	·79	·66	·82	·73
16	..	..	·01	..	..	·01	..	..	·03	..	..	·01	..
17	..	..	..	..	..	..	..	..	..	..	..	..	..
18	..	..	..	..	..	..	..	..	..	..	..	..	..
19	..	..	..	..	..	..	..	..	..	..	..	..	..
20	·01	..	..	..	..	..	·01	..	..	..	..	·01	·01
21	·18	·13	·09	·14	·14	·15	·13	·14	·14	·16	·20	·15	·17
22	·14	·13	·12	·14	·14	·13	·13	·12	·15	·15	·24	·15	·17
23	..	..	..	..	..	..	..	..	..	..	..	·01	..
24	..	..	..	..	..	..	..	..	..	..	..	..	..
25	..	..	..	..	..	..	..	..	..	..	..	..	..
26	·09	·09	·09	·10	·11	·14	·13	·17	·15	·14	·15	·13	·15
27	·09	·08	·06	·07	·09	·08	·09	·07	·13	·05	·11	·11	·09
28	..	..	..	..	..	..	..	..	..	..	..	..	..
29	..	..	..	..	..	..	..	..	..	..	..	..	..
30	..	..	..	..	..	..	..	..	..	..	..	..	..
31	..	..	..	..	..	..	..	..	..	..	..	..	..
Total	1·56	1·47	1·30	1·28	1·59	1·57	1·62	1·34	1·77	1·48	1·66	1·79	1·71
From Jan. 1	3·53	3·53	3·32	3·01	3·92	3·79	3·81	3·51	4·28	3·53	3·64	3·95	3·86

Day of Month	Keston (Heathfld.)	Keston (Tow. Fds.)	Orpington	Farningham Hill	Wilmington	Chislehurst	Bickley	Beckenham	South Norwood	Wimbledon (Sew. Wks.)	Wimbledon (Mt. Ararat)	Raynes Park	New Malden	Esher	Surbiton	Kingston	Richmond	Brixton	Wandswth. Common	West Norwood	Forest Hill Dartmh. rd.	Forest Hill (Nurseries)	Deptford	Greenwich	Woolwich
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·18	·19	..	·22	·13	·08	·10	·09	·15	·12	..	·10	·06	·02	·08	·03	·09	·13	·10	·10	·06	·12	·09	·09	·03
2	..	·01	..	..	..	·01	·04	..	..	·10	·06	·01	..	..	..	·03	..	·01	·02	·01	·04	·01	..	..	..
3	..	·01	..	..	..	..	·02	·02	..	..	..	·01	..	..	..	..	..	·01	·01	..	..	·01	..	·01	..
4	..	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·02	..	..	..
5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·02
6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
7	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·02	..	..	..	·03
9	·16	·15	·12	·15	·10	·15	·18	·15	·21	·16	·15	·30	·08	·08	·16	·15	·20	·15	·13	·17	·08	·12	·14	·13	..
10	·03	·03	·02	·04	·02	·05	·05	·03	·03	·03	..	·02	..	·02	..	·01	·02	·05	·03	·05	·10	·06	·02	·04	..
11	..	..	..	..	..	·02	·02	..	..	·01	..	·01	..	..	..	..	..	..	..	..	·01	..	..	..	..
12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
13	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
14	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·02
15	·87	·81	·77	·54	·57	·62	·65	·53	·60	·30	·34	·37	·27	·27	·41	·36	·21	·32	·23	·43	·36	·48	·26	·31	·31
16	·01	..	..	·01	..	.01	·02	..	·01	..	..	·01	..	·01	..	·01	·02	..	·01	·02	·01	·01	..	·01	·01
17	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
18	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
19	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
20	..	..	..	·01	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
21	·16	·16	·16	·26	·25	·19	·20	·14	·16	·13	·15	·14	·13	·10	·13	·16	·18	·12	·13	·16	·11	·20	·16	·18	·20
22	·16	·17	·16	·16	·14	·05	·15	·09	·12	·12	·11	·11	·10	·07	·11	·14	·09	·12	·09	·08	·16	·10	·07	·08	·06
23	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..
24	..	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
25	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	..	..	..
26	·15	·15	·14	·13	·10	·14	·15	·09	·10	·26	·16	·15	·15	·12	·15	·20	·15	·15	·17	·12	·11	·09	·07	·08	·09
27	·10	·12	·09	·10	·09	·08	·13	·07	·12	·08	·08	·08	·03	·03	·05	·07	·08	·11	·08	·09	·12	·08	·09	·11	·10
28	..	..	..	..	..	·01	·02	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·02	..	..	..
29	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
30	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
31	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Total	1·83	1·80	1·46	1·62	1·40	1·43	1·74	1·21	1·50	1·31	1·05	1·31	·82	·73	1·09	1·16	1·05	1·17	1·00	1·23	1·18	1·32	·90	1·04	·87
From Jan.1	4·15	4·34	2·73	3·44	3·03	3·58	4·03	3·01	3·72	3·15	2·66	3·57	2·08	1·91	2·40	3·02	2·97	3·12	3·00	3·11	3·51	3·44	2·65	3·16	2·51

Daily Rainfall. April, 1892.

Day of Month	Dorking	Caterham	Caterham Valley	Marden Park	Kenley	Purley (Reedham)	Purley (Tudor C.)	Ashtead	Oxshott	Banstead	Sutton	Carshalton	Wallington	Bedding-ton	Waddon	Croydon (Brim. Bn.)	Croydon (Whitgift)	Addiscmb. (Hvlk. Rd.)	Addiscmb. (Outm. Rd.)	Addington Hills	Addington (Park Fm.)	Addington (Pump. St.)	West Wickham	Hayes Common	Keston (Bradfield)
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
4	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
7	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
9	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
11	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
12	..	..	..	..	..	..	..	..	·01	..	..	·02	·01	·01	·01	..	·02	·02	·02	·01	..	·01	..	·02	·02
13	·10	·07	·06	·08	·08	·08	·07	·10	·11	·09	·11	·10	·12	·12	·11	·13	·13	·12	·11	·09	·09	·07	·09	·07	·09
14	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
15	·30	·37	·10	·32	·29	·37	·45	·11	·17	·46	·30	·49	·77	·56	·33	·50	·63	·58	·62	·21	·41	·22	·23	·92	·36
16	..	..	..	..	·01	..	..	·03	..	..	..	..	·01	·01	·02	..	..	..	..	..	·02	..	·02	·02	..
17	..	..	·01	..	..	..	..	..	·01	..	..	..	..	..	..	..	..	·01	·01	·02	·03	·01	·05	·04	·07
18	..	..	·03	·02	·03	·05	·03	..	..	..	·01	·03	·03	·05	·03	·04	·02	·01	·01	·01	·01	..	..	..	..
19	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
20	·21	·23	·14	·20	·22	·20	·20	·23	·21	·22	·21	·21	·24	·20	·20	·30	·20	·19	·19	·20	·19	·21	·21	·17	·12
21	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
22	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
23	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
24	·08	·10	·12	·05	·07	·08	·12	·09	·10	·08	·13	·14	·10	·09	·10	·08	·10	·10	·11	·10	·06	·11	·09	·09	·06
25	·14	·05	·05	·09	·08	·08	·05	·08	·05	·10	·08	·03	·08	·07	·08	·08	·07	·06	·04	·07	·10	·05	..	·06	·06
26	·03	..	..	..	·01	..	..	..	..	·06	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..
27	·26	·17	·27	·30	·32	·31	·28	·26	·26	·20	·26	·28	·27	·29	·25	·30	·28	·25	·26	·26	·27	·25	·33	·26	·25
28	·02	·16	·01	·02	·03	·03	·07	·03	·01	·01	·06	·02	·03	·01	·02	·04	·03	·03	·02	·02	·02	·01	·03	·04	..
29	..	·03	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..
30	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Total	1·14	1·18	·79	1·08	1·15	1·20	1·27	·93	·93	1·22	1·16	1·32	1·66	1·41	1·15	1·49	1·48	1·37	1·39	·99	1·22	·94	1·05	1·69	1·03
From Jan. 1	4·93	4·45	4·12	4·71	5·10	4·80	5·20	4·02	3·77	4·56	4·58	4·74	5·19	4·94	4·47	4·50	5·40	5·16	5·20	4·50	5·50	4·47	4·69	5·64	4·89

Daily Rainfall. April, 1892.

Day of Month	Keston (Heathfld.)	Keston (Tow. Fds.)	Orpington	Farningham Hill	Wilmington	Chislehurst	Bickley	Beckenham	South Norwood	Wimbledon (Sew. Wks.	Wimbledon (Mt. Ararat,	Raynes Park	New Malden	Esher	Surbiton	Kingston	Richmond	Brixton	Wandswth. Common	West Norwood	Forest Hill Dartmth.rd.	Forest Hill (Nurseries)	Deptford	Greenwich	Woolwich
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
4	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
7	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
9	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
11	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
12	·02	..	..	·02	·02	·01	·03	·01	·03	..	·02	·01	..	..	..	..	..	..	..	..	..	..	..	·01	·05
13	·08	·10	·07	·04	·06	·08	·14	·11	·13	·11	·10	·13	·09	·05	·10	·13	·17	·10	·09	·18	·17	·19	·08	·10	..
14	..	..	..	·02	..	..	..	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..
15	·28	·68	·54	·77	·66	·75	·97	·39	·53	·29	·31	·40	·12	·08	·18	·18	·13	·33	·23	·51	·39	·46	·52	·53	·33
16	..	·02	·07	·07	·03	·02	·03	..	..	..	..	..	..	·01	..	..	..	..	·01	..	..	..	..	·03	·01
17	·07	·07	..	·03	·03	·07	·15	·09	·02	·01	..	..	..	..	..	..	..	·04	..	·03	·08	·12	·10	·06	·03
18	..	..	..	..	..	..	..	..	·03	·17	·09	·05	·02	..	·02	·10	·13	·12	·22	·08	..	·05	..	..	..
19	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	..
20	·16	·15	·10	·10	·10	·12	·14	·13	·13	·20	·21	·23	·16	·12	·21	·23	·22	·16	·15	·16	·18	·13	·13	·14	·10
21	..	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
22	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
23	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
24	·08	·06	·03	·04	·06	·07	·07	·07	·14	·10	·05	·11	·12	·10	·13	·17	·12	·05	·08	·07	·06	·07	·05	·06	·11
25	·06	·14	·08	·06	·02	·08	·08	·05	·01	·07	·10	·06	·06	·03	·07	·05	·04	·11	·06	·09	·09	·12	·04	·06	·01
26	·01	·01	..	·02	..	·02	·05	..	..	..	..	·01	..	..	..	..	..	..	..	..	·01	·02	·03	·06	·04
27	·27	·27	·22	·22	·29	·33	·37	·32	·37	·20	·27	·38	·24	·23	·25	·26	·27	·33	·20	·26	·27	·31	·28	·31	·28
28	·05	·04	·10	·02	·02	·08	·07	·03	·02	·02	·03	·04	..	·02	·01	..	·01	..	·02	·03	·02	·03	·03	·06	·04
29	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	..	..
30	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Total	1·08	1·54	1·21	1·41	1·29	1·64	2·10	1·20	1·41	1·17	1·18	1·43	·81	·64	·97	1·12	1·09	1·25	1·07	1·41	1·27	1·50	1·26	1·42	1·00
From Jan. 1	5·23	5·88	3·94	4·85	4·32	5·22	6·13	4·21	5·13	4·32	3·84	5·00	2·89	2·55	3·37	4·14	4·06	4·37	4·07	4·52	4·78	4·94	3·91	4·58	3·51

Daily Rainfall. **May, 1892.**

Day of Month	Dorking	Caterham	Caterham Valley	Marden Park	Kenley	Purley (Reedham)	Purley (Tudor C.)	Ashtead	Oxshott	Banstead	Sutton	Carshalton	Wallington	Bedding-ton	Waddon	Croydon (Brim. Bn.)	Croydon (Whitgift)	Addiscmb. (Hvlk. Rd.)	Addiscmb. (Outm.Rd.)	Addington Hills	Addington (Park Fm.)	Addington (Pump. St.)	West Wickham	Hayes Common	Keston (Bradfield)
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..
2	..	·07	·10	·08	·10	·11	·09	·04	·03	·04	·07	·05	·07	·06	·05	·06	·06	·07	·06	·09	·10	·09	·12	·01	·09
3	..	..	·02	·04	·03	·02	·03	·02	·02	·02	..	·02	·02	·02	·02	..	·02	·05	·01	·03	·02	·01	·02	·02	·01
4	·05	..	·03	·01	·02	·01	·02	·02	·01	·01	·02	·01	·01	..	..	·03	·01	·01	·01	·01	·02	·01	·01	·01	·01
5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..
6	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
7	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
9	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
11	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
13	..	..	..	·01	·01	..	..	..	·01	..	..	..	..	..	·01	..	..	·01	·01	..	..	..	..	·01	..
14	..	·02	..	..	..	..	..	·02	..	..	..	..	..	..	..	..	..	..	·01	·01	·02	..	·01	..	..
15	·04	..	..	·02	·02	·01	..	·02	·01	..	·01	..	·01	·01	..	..	..	·01	..	..	·01	..	..	·01	·01
16	..	·02	·04	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
17	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	·02	·01
18	..	..	..	..	·01	..	..	·02	·03	..	·01	..	·01	·01	·01	·02	·01	·01	·01	·01	..	..	..	·01	·01
19	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	·01	..	..	..	..	·03	·01
20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
21	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
22	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
23	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
24	·06	..	..	..	·02	·01	..	·06	·09	..	·04	..	·02	·01	..	..	·01	·01	·01	..	..	..	..	..	..
25	·90	·77	·70	·73	1·03	·90	·98	·88	·64	1·00	·75	·80	·92	·98	·92	·85	·85	·93	·94	1·08	·84	·73	·62	·66	·54
26	·28	·22	·26	·23	·19	·19	·20	·27	·27	·26	·25	·34	·25	·19	·18	·16	·17	·16	·16	·21	·23	·24	·23	·22	·23
27	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	..	..
28	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
29	..	..	·01	..	·02	·01	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	..
30	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
31	·07	·11	·10	·08	·10	·08	·08	·09	·07	·03	·06	·04	·05	·08	·06	·07	·07	·06	·07	·06	·08	·08	·07	·05	·05
Total	1·40	1·21	1·26	1·21	1·58	1·34	1·40	1·44	1·18	1·36	1·21	1·26	1·36	1·36	1·25	1·19	1·20	1·35	1·31	1·50	1·34	1·16	1·08	1·05	·97
From Jan.1	6·33	5·65	5·38	5·92	6·68	6·14	6·60	5·46	4·95	5·92	5·79	6·00	6·55	6·30	5·72	5·69	6·60	6·51	6·51	6·00	6·84	5·63	5·77	6·69	5·86

Daily Rainfall. May, 1892.

Day of Month	Keston (Heathfld.)	Keston (Tow. Fds.)	Orpington	Farning-ham Hill	Wilming-ton	Chislehurst	Bickley	Beckenham	South Norwood	Wimbledon (Sew. Wks.)	Wimbledon (Mt. Ararat)	Raynes Park	New Malden	Esher	Surbiton	Kingston	Richmond	Brixton	Wandswth. Common	West Norwood	Forest Hill Dartmh. rd.	Forest Hill (Nurseries)	Deptford	Greenwich	Woolwich
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
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2	·10	·09	·10	·10	·04	·04	·09	·06	·07	·06	·06	·06	·02	·02	·04	·06	·06	·07	·05	·07	·08	·06	·06	·08	·03
3	·02	·01	·01	·02	·02	·02	·05	·03	·03	·04	·04	·04	·02	·03	·02	·04	·06	·04	·05	·04	·02	·02	·04	·06	·06
4	·02	·02	..	·02	·01	..	·03	·01	·01	·01	..	·02	..	·01	..	·01	·02	·03	·02	·01	·04	·03	·01	·01	·02
5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
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13	·02	·01	·01	·01	·01	..	·02	·01	·01	·02	·03	·02	..	·02	·01	·04	·09	·02	·02	·01	·01	..	·01	·02	·02
14	..	..	..	..	..	·12	..	..	..	·01	..	·01	..	..	..	..	..	·01	·02	·01	·02	·01	..	·03	·02
15	..	..	..	·01	..	..	..	..	·01	·01	·01	·03	..	·01	..	·01	·01	..	·01	..	..	..	..	..	..
16	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
17	·02	·02	..	·02	..	·02	·02	·01	·01	·03	..	..	..	..	..	..	..	·01	..	·01	·01	·01	..	·02	..
18	·02	·02	·02	..	..	·01	·01	·01	·01	..	·01	·03	..	..	..	·01	·01	..	·01	·01	·02	·02	..	·01	..
19	·02	·04	·04	·04	·12	·04	..	·05	..	..	..	·02	..	·01	..	·03	·01	·05	·07	·06	·06	·04	·09	·15	·03
20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
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24	..	..	..	..	..	..	..	..	·01	·05	·04	·05	·03	·03	·10	·13	·05	·01	·05	·01	..	·02	·02	·01	..
25	·53	·47	·58	·80	·91	·57	·72	·92	·84	1·00	1·00	1·02	·80	·85	·72	·79	·68	·72	·86	·78	1·13	·97	1·05	1·01	·70
26	·21	·27	·14	·10	·10	·17	·22	·20	·15	·30	·34	·34	·20	·24	·34	·29	·27	·29	·29	·18	·17	·28	·16	·21	·18
27	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
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30	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
31	·06	·06	·03	·20	·05	·06	·06	·04	·06	·05	·06	·06	·04	·04	·04	·05	·05	·05	·06	·06	·05	·05	·02	·05	·05
Total	1·02	1·01	·93	1·32	1·26	1·05	1·22	1·34	1·21	1·68	1·59	1·70	1·11	1·22	1·27	1·46	1·31	1·30	1·51	1·25	1·61	1·51	1·46	1·66	1·15
From Jan. 1	6·25	6·89	4·87	6·17	5·58	6·27	7·35	5·55	6·34	6·00	5·43	6·70	4·00	3·77	4·64	5·60	5·37	5·67	5·58	5·77	6·39	6·45	5·37	6·24	4·66

Daily Rainfall. June, 1892.

Day of Month	Dorking	Caterham	Caterham Valley	Marden Park	Kenley	Purley (Reedham)	Purley (Tudor C.)	Ashtead	Oxshott	Banstead	Sutton	Carshalton	Wallington	Bedding-ton	Waddon	Croydon (Brim. Bn.)	Croydon (Whitgift)	Addiscmb. (Hvlk. Rd.)	Addiscmb. (Outm. Rd.)	Addington Hills	Addington (Park Fm.)	Addington (Pump. St.)	West Wickham	Hayes Common	Keston (Bradfield)
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·27	·38	·30	·32	·26	·19	·24	·13	·13	·18	·16	·14	·15	·14	·12	·09	·15	·16	·17	·19	·20	·20	·20	·21	·26
2	·10	·05	·07	·12	·15	·10	·09	·09	·07	·10	·08	·02	·08	·09	·10	·09	·10	·08	·08	·12	·15	·15	·22	·12	·10
3	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
4	·21	·20	·20	·27	·17	·16	·19	·15	·15	·15	·13	·24	·17	·18	·17	·18	·20	·16	·18	·14	·18	·15	·21	·14	·13
5	·13	·26	·34	·12	·24	·28	·31	·26	·22	·20	·45	·32	·52	·42	·38	·26	·24	·21	·20	·29	·15	·37	·38	·20	·19
6	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..
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12	·07	·08	·11	·06	·04	·05	·05	·01	·01	·01	·05	·05	·05	·05	·05	·06	·04	·06	·06	·06	·05	·03	·06	·08	·07
13	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
14	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
15	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
16	·02	·15	·18	·13	·20	·18	·26	·04	·03	·13	·15	·21	·22	·24	·24	·25	·22	·23	·23	·24	·24	·22	·24	·26	·33
17	..	·06	..	·05	·04	·04	·05	·03	..	·02	·02	..	·01	..	..	..	..	..	..	..	..	·01	·03	..	..
18	·08	·03	·09	·05	·07	..	·10	..	·02	..	..	..	·01	·01	·02	..	·01	·02	·02	·02	·01	·02	..	·02	·01
19	·13	·29	·12	·25	·26	·28	·21	·40	·35	·17	·40	·28	·32	·29	·29	·35	·32	·33	·31	·27	·30	·22	·30	·30	·24
20	·20	·11	·14	·13	·12	·11	·10	·15	·10	·10	·11	·11	·08	·08	·08	·10	·08	·08	·08	·13	·09	·09	·12	·09	·05
21	·06	·21	·25	·22	·12	·09	·09	·04	·04	·03	·06	·03	·04	·04	·05	·05	·05	·06	·05	·10	..	·13	·19	·14	·16
22	·15	·21	·28	·20	·20	·18	·21	·25	·13	·13	·15	·40	·15	·16	·16	·16	·18	·18	·20	·19	·22	·17	·21	·19	·21
23	·41	·50	·41	·43	·52	·53	·55	·38	·39	·46	·47	·26	·48	·53	·57	·68	·65	·60	·56	·65	·42	·52	·55	·51	·56
24	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
25	·02	..	·01	..	·01	·01	·03	..	..	..	..	..	..	..	..	..	..	..	..	..	·30	..	..	·01	..
26	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
27	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
28	·52	2·45	2·50	2·12	·94	·75	·75	·30	·32	·59	·60	·59	·63	·66	·63	·55	·64	·58	·60	·76	1·35	1·81	1·95	1·76	1·71
29	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
30	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Total	2·37	4·98	5·00	4·48	3·35	2·95	3·23	2·23	1·96	2·27	2·83	2·65	2·91	2·89	2·86	2·82	2·88	2·75	2·74	3·16	3·66	4·09	4·66	4·04	4·02
From Jan.1	8·70	10·63	10·38	10·40	10·03	9·09	9·83	7·69	6·91	8·19	8·62	8·65	9·46	9·19	8·58	8·51	9·48	9·26	9·25	9·16	10·50	9·72	10·43	10·73	9·88

Day of Month	Keston (Heathfld.)	Keston (Tow. Fds.)	Orpington	Farning-ham Hill	Wilming-ton	Chislehurst	Bickley	Beckenham	South Norwood	Wimbledon (Sew. Wks.)	Wimbledon (Mt. Ararat)	Raynes Park	New Malden	Esher	Surbiton	Kingston	Richmond	Brixton	Wandswth. Common	West Norwood	Forest Hill Dartmh. rd.	Forest Hill (Nurseries)	Deptford	Greenwich	Woolwich
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·28	·13	·27	·05	·11	·16	·20	·10	·14	·08	·03	·09	·09	·06	·07	·13	·07	·04	·05	·11	..	·03	·03	·07	GAUGE STOLEN. RECORD CEASED.
2	·15	·27	·12	..	·07	·11	·08	·06	..	·09	·12	·09	..	·06	·07	·05	·11	·12	·06	·08	·08	·10	·05	·06	
3	..	..	..	·30	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
4	·17	·13	·13	·17	·09	·13	·12	·10	·30	·08	·12	·13	·11	·04	·12	·21	·12	·07	·07	·09	·07	·01	·03	·06	
5	·33	·19	·31	·15	·36	·25	·23	·19	·22	·19	·20	·22	·13	·40	·29	·11	·13	·07	·09	·21	·24	·30	·09	·20	
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7	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
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10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
11	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
12	·09	·08	·08	·17	·14	·10	·12	·08	·07	·06	·05	·05	·03	·03	·04	·04	·06	·13	·11	·08	·11	·13	·14	·18	
13	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
14	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
15	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
16	·33	·27	·24	·22	·15	·24	·33	·30	·27	·25	·24	·23	·23	·09	·17	·18	·18	·17	·19	·21	·26	·28	·10	·11	
17	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	
18	·02	·02	·02	·03	..	..	·02	·01	·02	·03	·01	·01	..	·02	·01	..	·05	·04	·04	·02	..	·02	·02	·04	
19	·27	·27	·24	·25	·26	·25	·25	·26	·24	·39	·38	·39	·23	·18	·26	·37	·16	·15	·12	·28	·27	·30	·12	·14	
20	·07	·08	·07	·10	·05	·07	·10	·09	·09	·04	·03	·05	·03	·06	·01	·04	·03	·03	·02	·07	·06	·07	·06	·08	
21	..	·14	·12	·09	·13	·16	·06	·06	·04	·05	·04	·06	..	·02	·02	·02	·01	·06	·03	·09	·08	·07	·05	·07	
22	·21	..	·44	·13	·16	·22	·22	·15	·34	·16	·19	·15	·18	·11	·13	·20	·16	·14	·16	·19	..	·14	·17	·20	
23	·52	·77	·21	·41	·46	·49	·50	·50	·44	·61	·50	·61	·34	·36	·25	·48	·45	·65	·56	·52	·55	·57	·51	·47	
24	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
25	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	·02	
26	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
27	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
28	1·57	1·45	1·43	1·95	1·93	1·45	1·54	·52	·65	1·02	1·35	1·11	·71	1·23	·80	1·19	1·03	·81	·72	·49	·61	·57	·61	·57	
29	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	
30	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
Total	3·94	3·80	3·68	4·02	3·91	3·63	3·77	2·42	2·82	3·05	3·26	3·20	2·08	2·66	2·34	3·02	2·56	2·48	2·23	2·45	2·33	2·59	1·99	2·27	
From Jan. 1	10·19	10·69	8·55	10·19	9·49	9·90	11·12	7·97	9·16	9·05	8·69	9·90	6·08	6·43	6·98	8·62	7·93	8·15	7·81	8·22	8·72	9·04	7·36	8·51	

Day of Month	Dorking	Caterham	Caterham Valley	Marden Park	Kenley	Purley (Reedham)	Purley (Tudor C.)	Ashtead	Oxshott
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	..	..	..	..	..	..	..	..
2	..	..	..	..	..	..	..	..	..
3	..	..	..	..	..	..	..	..	..
4	·02	·14	·23	·14	·28	·30	·10	·03	·01
5	·40	·38	·44	·32	·36	·33	·33	·35	·39
6	·04	·06	·06	..	·03	..	·04	·01	·01
7	·04	·02	..	·05	·05	·04	..	·01	..
8	..	..	..	..	..	..	..	..	..
9	..	..	..	..	..	..	..	..	..
10	..	..	..	..	..	..	..	..	..
11	..	..	..	..	..	..	..	..	..
12	·22	·18	·04	·17	·16	·16	·19	·29	·29
13	·25	·10	·40	·08	·77	·70	·48	·50	·70
14	..	·08	..	·01	·01	·01	..	·01	..
15	..	·02	..	..	..	..	..	..	..
16	·12	·14	·12	·08	·10	·09	·09	·06	·10
17	·23	·18	·16	·18	·15	·16	·09	·25	·21
18	·12	·10	·13	·06	·11	·11	·13	·15	·13
19	·53	·56	·50	·55	·54	·48	·54	·47	·43
20	..	·04	..	..	..	..	..	..	..
21	..	..	·04	..	..	..	..	..	..
22	..	..	..	..	..	..	..	..	..
23	..	..	..	..	..	..	..	..	..
24	..	..	..	..	..	..	..	..	..
25	..	..	..	..	..	..	..	..	..
26	..	..	·03	..	..	..	..	..	..
27	..	..	..	..	..	..	..	..	..
28	..	..	..	..	..	..	..	..	..
29	·08	·32	..	·32	·05	..	·09	·06	·01
30	·06	·02	·15	·06	·14	·15	·17	·06	·07
31	..	·01	·02	·01	·03	·02	·02	..	..
Total	2·11	2·35	2·32	2·03	2·78	2·55	2·27	2·25	2·35
From Jan. 1	10·81	12·99	12·70	12·43	12·81	11·64	12·10	9·94	9·26

Day of Month	Banstead	Sutton	Carshalton	Wallington	Bedding-ton	Waddon	Croydon (Brim. Bn.)	Croydon (Whitgift)
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	..	..	..	..	..	..	..
2	..	..	..	..	..	..	..	..
3	..	..	..	..	..	..	..	..
4	·07	..	..	..	..	..	..	..
5	·39	·39	·39	·37	·38	·35	·44	·38
6	..	..	..	..	..	·01	..	..
7	..	..	..	..	..	..	..	..
8	..	..	..	..	..	..	..	..
9	..	..	..	..	..	..	..	..
10	..	..	..	..	..	..	..	..
11	..	..	..	..	..	..	..	..
12	·20	·22	·17	·18	·21	·26	·28	·25
13	·32	·18	·62	·44	·43	·40	·56	·52
14	..	..	..	..	..	..	..	..
15	..	..	..	..	..	..	..	..
16	·06	·05	·08	·07	·06	·06	·06	·08
17	·23	·20	·19	·20	·20	·18	·22	·21
18	·12	·13	·10	·11	·10	·10	·11	·11
19	·48	·46	·46	·46	·46	·45	·48	·53
20	..	..	..	..	·01	·01	..	..
21	..	..	..	..	..	..	..	..
22	..	..	..	..	..	..	..	..
23	..	..	..	..	..	..	..	..
24	..	..	..	..	..	..	..	..
25	..	..	..	..	..	..	..	..
26	..	..	..	..	..	..	..	..
27	..	..	..	..	..	..	..	..
28	..	..	..	..	..	..	..	..
29	·06	·03	..	·02	·02	·03	..	·03
30	·09	·09	·07	·10	·09	·09	·12	·09
31	·01	·02	·01	·01	·02	·03	·05	·05
Total	2·03	1·77	2·09	1·96	1·98	1·97	2·32	2·25
From Jan. 1	10·22	10·39	10·74	11·42	11·17	10·55	10·83	11·73

Day of Month	Addiscmb. (Hvlk. Rd.)	Addiscmb. (Outm. Rd.)	Addington Hills	Addington (Park Fm.)	Addington (Pump. St.)	West Wickham	Hayes Common	Keston (Bradfield)
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	..	..	..	..	..	..	..
2	..	..	..	..	..	..	..	..
3	..	..	..	..	..	..	..	..
4	·01	·01	..	·11	·17	·14	·05	·08
5	·34	·34	·32	·33	·33	·35	·36	·30
6	·01	..	..	..	..	·02	..	..
7	..	..	..	..	..	..	..	..
8	..	..	..	..	..	..	..	..
9	..	..	..	..	..	·01	..	..
10	..	..	..	..	..	..	..	..
11	..	..	..	..	..	..	..	..
12	·24	·22	·23	·16	·17	·16	·12	·15
13	·65	·58	·30	·46	·35	·45	·41	·80
14	..	..	·01	..	..	..	·01	..
15	..	..	..	..	..	..	..	..
16	·11	·11	·10	·05	·11	·10	·08	·11
17	·20	·20	·20	·21	·12	·15	·14	·14
18	·12	·11	·12	·09	·09	·12	·09	·09
19	·53	·54	·53	·54	·55	·61	·56	·55
20	..	..	..	..	..	..	..	..
21	..	..	..	..	..	..	..	..
22	..	..	..	..	..	..	..	..
23	..	..	..	..	..	..	..	..
24	..	..	..	..	..	..	..	..
25	..	..	..	..	..	..	..	·01
26	..	..	..	..	..	..	..	..
27	..	..	..	..	..	..	..	..
28	..	..	..	..	..	..	..	..
29	·03	·03	·06	..	·04	..	·06	·05
30	·10	·10	·16	·26	·15	·23	·16	·17
31	·04	·03	·04	·02	·02	·03	·06	·06
Total	2·38	2·27	2·07	2·23	2·10	2·37	2·10	2·51
From Jan. 1	11·64	11·52	11·23	12·73	11·82	12·80	12·83	12·29

Day of Month	Keston (Heathfd.)	Keston (Tow. Fds.)	Orpington	Farning-ham Hill	Wilming-ton	Chislehurst	Bickley	Beckenham	South Norwood	Wimbledon (Sew. Wks.)	Wimbledon (Mt. Ararat)	Raynes Park	New Malden	Esher	Surbiton	Kingston	Richmond	Brixton	Wandswth. Common	West Norwood	Forest Hill Dartmh. rd.	Forest Hill (Nurseries).	Deptford	Greenwich	Woolwich
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	GAUGE STOLEN. RECORD CEASED.
2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
4	·10	·08	·19	·15	..	..	..	..	..	..	..	..	..	·02	..	·02	..	..	..	..	..	..	..	..	
5	·35	·35	·27	·26	·21	·36	·35	·35	·41	·46	·49	·48	·40	·42	·44	·54	·46	·43	·28	·48	·45	·42	·41	·44	
6	·02	..	..	..	..	..	..	..	..	·02	·01	·01	..	·01	..	·02	·02	..	·02	..	..	..	..	·01	
7	·01	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	..	
8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
9	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	
10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
11	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
12	·14	·12	·07	·06	·19	·09	·14	·10	·22	·28	·34	·23	·41	·29	·34	·43	·30	·15	·26	·24	·18	·11	·05	·09	
13	·73	·75	·54	·51	1·28	·68	·17	·36	·21	·08	·23	·26	·12	·26	·16	·21	·27	·13	·04	·78	·88	·99	·06	·02	
14	..	..	..	..	·01	..	·03	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	·01	..	..	
15	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
16	·11	..	·08	·05	·01	..	·04	·04	·12	·06	·10	·08	·05	·09	·05	·37	·17	·03	·08	·07	·08	·10	·01	·10	
17	·16	·23	·16	·21	·16	·17	·16	·17	·15	·18	·22	·25	·22	·20	·26	·06	·24	·19	·15	·21	·21	·22	·21	·13	
18	·09	·09	·08	·10	·10	·11	·11	·08	·10	·12	·08	·12	·10	·10	·10	·13	·12	·12	·11	·13	·12	·11	·09	·10	
19	·58	·54	·48	·52	·66	·62	·58	·47	·52	·44	·44	·46	·35	·26	·42	·49	·45	·48	·29	·49	·53	·57	·60	·59	
20	..	..	..	..	..	..	·02	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
21	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
22	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
23	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
24	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
25	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
26	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
27	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
28	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
29	·06	..	·06	·06	·01	..	..	..	·01	..	..	·03	..	..	..	..	..	..	..	·02	·01	..	..	..	
30	·23	·24	·15	·21	·12	..	·11	·04	·05	..	·03	·01	·02	·01	..	..	..	..	..	..	..	..	..	..	
31	·02	·10	·08	·06	·08	·12	·05	·04	·03	·04	·01	·02	..	·02	·03	..	·03	·04	·04	·06	·06	·06	·03	·04	
Total	2·61	2·50	2·16	2·20	2·83	2·15	1·76	1·65	1·82	1·68	1·95	1·96	1·67	1·68	1·80	2·27	2·06	1·58	1·27	2·46	2·52	2·59	1·46	1·53	
From Jan. 1	12·80	13·19	10·71	12·39	12·32	12·05	12·88	9·62	10·98	10·73	10·64	11·86	7·75	8·11	8·78	10·89	9·99	9·73	9·08	10·68	11·24	11·63	8·82	10·04	

Daily Rainfall. *The 50 years (1841–90) mean at Greenwich for August is 2·34 in.* **August, 1892.**

Day of Month	Dorking	Caterham	Caterham Valley	Marden Park	Kenley	Purley (Reedham)	Purley (Tudor C.)	Ashtead	Oxshott	Banstead	Sutton	Carshalton	Wallington	Bedding-ton	Waddon	Croydon (Brim. Bn.)	Croydon (Whitgift)	Addiscmb. (Hvlk. Rd.)	Addiscmb. (Outm. Rd.)	Addington Hills	Addington (Park Fm.)	Addington (Pump. St.)	West Wickham	Hayes Common	Keston (Bradfield)
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	..	..	..	·02	..	·03	·01	..	..	·01	..	..	·01	·01	·02	..	·02	·01	·03	·02	·02	·01	·01	·01
2	·02	·02	..	·02	·02	·03	·04	..	..	..	·01	·03	·03	·02	·01	..	·01	·01	·01	·02	..	..	·01	..	·01
3	..	..	..	..	..	..	·02	·06	..	..	·01	·01	·01	·01	..	·02	..	..	..	..	..	..	..	..	..
4	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
5	..	..	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
6	·35	·27	·35	·11	·32	·28	·36	·31	·29	·36	·28	·24	·26	·22	·21	·36	·22	·20	·20	·25	·29	·30	·28	·22	·24
7	·04	·04	·04	·14	·05	·02	·05	·08	·13	·04	·13	·11	·09	·10	·10	·13	·12	·12	·12	·07	·05	·05	·05	·07	·06
8	·15	·16	·15	·21	·15	·10	·19	·10	·10	·14	·20	·20	·23	·22	·21	·25	·24	·26	·26	·26	·23	·22	·23	·25	·24
9	..	..	..	..	·01	..	..	..	..	..	..	·01	..	..	..	·01	..	..	..	..	..	..	..	·01	..
10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
11	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
12	..	..	..	·05	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
13	·03	·05	..	·08	·03	·02	·03	·03	·04	·01	·03	·02	·01	·01	..	..	..	·01	·01	·02	·01	·02	·02	·01	·02
14	·05	..	·12	..	·05	·03	..	·01	·01	·03	·02	..	·01	·01	·01	·02	·02	·01	·01	·03	·04	·03	..	·02	·05
15	..	..	..	..	..	..	..	..	·02	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
16	·06	·17	·13	·03	·04	·03	·05	..	..	·02	..	..	·02	·02	·03	..	·03	·03	·02	·03	..	·03	·13	·03	..
17	·06	·04	·07	·12	·09	·05	·08	·13	·03	·05	·07	·04	·06	·05	·05	·08	·05	·05	·05	·08	..	·10	·02	·09	·08
18	·54	·70	·83	·84	·73	·79	·89	·53	·42	·48	·46	·43	·44	·51	·55	·55	·62	·77	·79	·76	·85	·78	·81	·66	·83
19	·03	·10	·15	·15	·17	·18	·18	·09	·02	·10	·16	·11	·10	·11	·16	·16	·21	·24	·22	·17	·23	·19	·28	·25	·22
20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
21	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
22	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
23	..	·10	·10	·14	·09	·09	·09	..	..	·03	·06	·05	·07	·08	·09	·10	·08	·11	·10	·14	·15	·15	·17	·08	·14
24	·06	·04	..	·04	·03	03	..	·03	·02	·01	·03	·03	·03	·03	·03	·04	·03	·03	·03	·04	·05	·05	·08	·05	·05
25	·05	..	..	..	..	..	·04	·02	·03	..	·05	·11	·03	·05	·08	·14	·15	·11	·08	·04	·05	·04	·02	·01	·02
26	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
27	1·60	·90	·65	1·52	1·66	1·13	1·51	1·38	1·46	1·12	·97	1·22	·96	·91	·92	·83	1·04	·99	·96	·96	·90	1·03	·77	·79	·75
28	·10	·72	·68	·08	·08	·51	·30	·27	·21	·51	·32	·07	·33	·39	·30	·38	·26	·26	·27	·45	·64	·63	·87	·57	·62
29	·25	·13	·15	·13	·17	·16	·14	·04	·08	·15	·21	·23	·07	·04	·04	·06	·08	·11	·12	·13	·06	·05	·13	·04	·08
30	..	·01	..	..	·02	..	·07	·09	·01	..	·03	..	·03	·01	..	·02	..	..	·01	..	..	..	..	..	..
31	·08	·04	·09	·03	·12	·11	·24	·33	·23	·16	·25	·23	·23	·23	·20	·22	·22	·19	·18	·33	·33	·11	·06	·36	·22
Total	3·47	3·49	3·51	3·69	3·85	3·56	4·32	3·51	3·10	3·21	3·30	3·14	3·01	3·03	3·00	3·39	3·38	3·52	3·45	3·81	3·90	3·80	3·94	3·52	3·64
From Jan. 1	14·28	16·48	16·21	16·12	16·66	15·20	16·42	13·45	12·36	13·43	13·69	13·88	14·43	14·20	13·55	14 22	15·11	15·16	14·97	15·04	16·63	15·62	16·74	16·35	15·93

Daily Rainfall. *The 50 years (1841–90) mean at Greenwich for August is 2·34 in.* **August, 1892.**

Day of Month	Keston (Heathfld.)	Keston (Tow. Fds.)	Orpington	Farningham Hill	Wilmington	Chislehurst	Bickley	Beckenham	South Norwood	Wimbledon (Sew. Wks.)	Wimbledon (Mt. Ararat)	Raynes Park	New Malden	Esher	Surbiton	Kingston	Richmond	Brixton	Wandswth. Common	West Norwood	Forest Hill Dartmh. rd.	Forest Hill (Nurseries)	Deptford	Greenwich	Woolwich
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·02	·01	·01	·03	·01	·05	·01	·01	·02	..	..	·01	..	..	..	..	..	·01	·02	..	·01	·02	..	·01	GAUGE STOLEN. RECORD CEASED.
2	·02	..	..	·01	..	..	..	..	·01	·03	·03	·04	·03	·01	·02	..	·01	·01	·01	·01	..	..	..	..	
3	..	..	..	..	·01	..	..	..	..	..	..	·02	..	·01	·02	..	..	..	..	..	..	..	..	..	
4	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
6	·27	·24	·21	·18	..	·18	·18	·16	·20	·18	·21	·23	·20	·21	·25	·25	·14	·11	·11	·19	·05	..	·08	·09	
7	·07	·06	·06	·04	·14	·09	·11	·07	·12	·08	·11	·11	·10	·08	·09	·11	·09	·05	·08	·08	·04	·27	·03	·05	
8	·24	·25	·22	·41	·66	·53	·47	·41	·31	·48	·36	·28	·21	·17	·15	·36	·36	·54	·57	·49	·62	·60	·40	·38	
9	..	..	..	..	..	..	..	..	..	·04	..	·02	..	..	..	..	..	..	·01	..	..	..	..	..	
10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
11	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
13	·04	·02	·03	·03	·01	..	·02	·01	·02	·05	·07	·08	..	·05	·05	..	·02	·04	·03	·04	·04	..	·02	·02	
14	·07	·07	·02	·02	..	·04	·02	..	·01	·01	·01	·01	·04	..	·01	·01	..	..	·01	·01	·01	·04	..	..	
15	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
16	·06	·04	·06	·05	·04	..	..	·01	..	·03	·03	·04	·03	·05	·02	·03	·03	·02	·03	·02	..	..	·02	·02	
17	·10	..	·17	·13	·15	..	·09	·07	·07	·05	..	..	·04	·02	·03	·05	·03	..	..	·05	·01	·01	·05	·06	
18	·76	·83	·62	·70	·69	·88	·67	·68	·61	·40	·55	·47	·40	·41	·42	·49	·41	·47	·49	·40	·49	·55	·42	·46	
19	·22	·21	·22	·21	·11	·14	·22	·35	·26	·20	·14	·19	·05	·07	·05	·02	·18	·20	·19	·26	·37	·30	·21	·23	
20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
21	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
22	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	
23	·15	·14	·09	·04	·03	·09	·12	·12	·10	·06	·05	·06	·04	·01	·07	·07	·05	·05	·07	·07	·12	·13	·11	·09	
24	·06	·06	·07	·13	·12	·07	·07	·05	·04	·07	·02	·04	·03	·03	..	·01	·03	·04	·04	..	·04	·04	·04	·06	
25	..	..	..	..	..	..	..	..	·08	..	..	..	..	·01	·06	..	·01	..	..	..	..	·01	..	..	
26	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·03	..	..	..	..	
27	·80	·68	·77	·71	·62	1·30	1·02	·72	1·06	1·54	1·72	1·60	1·50	1·26	1·75	1·85	1·70	·92	1·58	1·32	1·04	·97	·97	1·26	
28	·69	·72	·64	·51	·48	·06	·44	·29	·07	·21	·21	·27	·21	·12	·10	·11	·09	·76	·10	·15	·20	·26	·35	·07	
29	·14	·10	·05	·04	·03	·05	·04	·08	·06	·04	·03	·05	·03	·04	·05	·05	·05	·04	·03	·10	·02	·04	·05	·05	
30	..	..	..	·01	..	..	..	..	..	·08	·08	·09	..	·02	·07	·04	·06	·10	·04	·02	·07	·04	·05	·02	
31	·19	·31	·14	·11	·12	·18	·20	·21	·25	·20	·15	·15	·13	·16	·08	·19	·18	·15	·09	·11	·14	·19	·16	·16	
Total	3·90	3·74	3·38	3·36	3·22	3·66	3·68	3·24	3·29	3·75	3·77	3·76	3·24	2·71	3·29	3·64	3·44	3·51	3·50	3·35	3·27	3·48	2·96	3·03	
From Jan. 1	16·70	16·93	14·09	15·75	15·54	15·71	16·56	12·86	14·27	14·48	14·41	15·62	10·99	10·82	12·07	14·53	13·43	13·24	12·58	14·03	14·51	15·11	11·78	13·07	

Daily Rainfall. *The 50 years (1841–90) mean at Greenwich for September is 2·25 in.* **September, 1892.**

Day of Month	Dorking	Caterham	Caterham Valley	Marden Park	Kenley	Purley (Reedham)	Purley (Tudor C.)	Ashtead	Oxshott	Banstead	Sutton	Carshalton
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·11	·05	·13	·07	·08	·03	·06	·05	·04	·04	·04	..
2	·32	·54	·60	·33	·25	·19	·21	·11	·15	·25	·12	·16
3	·14	·26	..	·29	·19	·17	·10	·03	·04	·07	·19	·15
4	..	..	..	..	..	..	..	·01	..	..	..	..
5	..	..	..	..	..	..	..	..	..	..	..	..
6	..	..	..	..	..	..	..	..	..	..	..	..
7	·03	·08	·02	·04	·02	·02	·04	·04	·03	..	·07	·02
8	..	..	..	..	..	..	..	..	..	..	..	..
9	..	..	..	..	..	·01	..	..	..	..	·01	..
10	..	..	..	·01	·03	·02	·03	·01	..	·06	·02	·03
11	·03	..	·05	·01	..	..	..	..	..	..	..	..
12	..	..	..	..	·01	..	..	..	..	..	..	..
13	..	..	..	..	..	..	..	..	..	..	..	..
14	..	..	..	..	..	..	..	..	..	..	..	..
15	..	..	..	..	..	..	..	..	..	..	..	..
16	·05	·05	..	·01	·03	·04	·05	·03	·02	..	·03	·02
17	..	..	..	..	..	..	..	..	..	..	..	..
18	..	..	..	..	..	..	..	..	..	..	..	..
19	·03	·13	·19	·07	·03	·02	·04	..	·04	·04	·04	·03
20	·13	·20	·11	·02	·15	·07	·09	·12	·11	·14	·17	·14
21	·09	·10	·15	·19	·11	·16	·05	·25	·24	·14	·13	·10
22	·02	·01	..	·03	·03	·04	·20	·24	·01	·02	·02	·01
23	..	..	..	..	·01	·01	..	·01	·01	..	..	..
24	..	..	..	..	..	..	..	..	..	..	..	..
25	..	..	..	..	..	..	..	·01	..	..	..	..
26	..	..	..	..	..	..	..	..	..	..	..	..
27	·26	·22	·20	·20	·23	·24	·25	·23	·20	·20	·20	·21
28	..	..	..	..	..	..	..	..	..	..	..	..
29	·98	·88	·85	·77	·88	·86	·99	·90	·93	·99	·94	·90
30	·24	·16	·25	·12	·14	·11	·08	·22	·23	·08	·10	·10
Total	2.43	2·68	2·55	2·16	2·19	1·99	2·19	2·26	2·05	2·03	2·08	1·87
From Jan. 1	16·71	19·16	18·76	18·28	18·85	17·19	18·61	15·71	14·41	15·46	15·77	15·75

Day of Month	Wallington	Bedding-ton	Waddon	Croydon (Brim. Bn.)	Croydon (Whitgift)	Addiscmb. (Hvlk. Rd.)	Addiscmb. (Outm. Rd.)	Addington Hills	Addington (Park Fm.)	Addington (Pump. St.)	West Wickham	Hayes Common	Keston (Bradfield)
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·02	·02	·03	·04	·04	·04	·03	·04	·23	·05	·06	·03	·02
2	·11	·11	·08	·14	·13	·12	·11	·14	..	·21	·26	·15	·16
3	·13	·11	·09	·14	·13	·10	·09	·09	·06	·10	·16	..	·09
4	..	..	..	..	..	..	..	..	..	..	..	..	..
5	..	..	..	..	..	..	..	..	..	..	..	..	..
6	..	..	..	..	..	..	..	..	..	..	..	..	..
7	·05	·02	·01	·02	·02	·02	·02	·04	..	·02	·01	..	·01
8	..	..	..	..	..	..	..	..	..	..	..	·01	..
9	..	..	..	..	..	·03	..	..	·02	..	..	..	..
10	·04	·07	·10	·10	·10	·11	·10	·10	·10	·10	·08	·11	·13
11	..	..	·01	..	..	..	..	..	..	..	..	..	..
12	..	..	..	..	..	..	..	..	..	..	..	..	..
13	..	..	..	..	..	..	..	..	..	..	..	..	..
14	..	..	..	..	..	..	..	..	..	..	..	..	..
15	..	..	..	..	..	..	..	..	..	..	..	..	..
16	·08	·09	·06	·09	·07	·05	·05	·06	·02	·01	·02	·01	·01
17	..	..	..	..	..	..	..	..	..	..	..	..	..
18	..	..	..	..	..	..	..	..	..	..	..	..	..
19	·04	·03	·03	·03	·03	·03	·03	·03	·02	·04	·08	·04	·07
20	·09	·13	·11	·08	·10	·08	·07	·09	·05	·07	..	·15	·15
21	·12	·11	·16	·15	·16	·15	·16	·10	·16	·13	·27	·26	·20
22	·01	·01	·01	·02	·02	·02	·02	·06	·03	·07	·07	·03	·07
23	..	..	..	..	..	..	..	..	..	..	..	..	..
24	..	..	..	..	..	..	..	..	..	..	..	..	..
25	..	..	..	..	..	..	..	·01	..	·01	..	..	..
26	..	..	..	..	..	..	..	..	..	..	..	..	..
27	·22	·21	·23	·23	·24	·25	·25	·26	·26	·25	·27	·23	·22
28	..	..	..	..	..	..	..	..	..	..	..	..	..
29	·95	·96	·90	·90	·93	·92	·89	·87	·81	·83	·82	·78	·72
30	·08	·07	·08	·06	·07	·10	·13	·08	·03	·07	·04	·08	·07
Total	1·94	1·94	1·90	2·00	2·04	2·02	1·95	1·97	1·79	1·96	2·14	1·88	1·92
From Jan. 1	16·37	16·14	15·45	16·22	17·15	17·18	16·92	17·01	18·42	17·58	18·88	18·23	17·85

Daily Rainfall. *The 50 years (1841–90) mean at Greenwich for September is 2·25 in.* **September, 1892.**

Day of Month	Keston (Heathfd.)	Keston (Tow. Fds.)	Orpington	Farning-ham Hill	Wilming-ton	Chislehurst	Bickley	Beckenham	South Norwood	Wimbledon (Sew. Wks.)	Wimbledon (Mt. Ararat)	Raynes Park	New Malden	Esher	Surbiton	Kingston	Richmond	Brixton	Wandswth. Common	West Norwood	Forest Hill Dartmh. rd.	Forest Hill (Nurseries)	Deptford	Greenwich	Woolwich
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·04	·03	·02	·02	·02	·03	·04	·03	·03	·03	·02	·04	·01	·04	·02	·04	·05	·02	·02	·01	·03	·03	·03	·04	GAUGE STOLEN. RECORD CEASED.
2	·21	·18	·15	·08	·08	·14	·13	·16	·22	·25	·22	·20	·20	·17	·26	·23	·25	·20	·13	·18	·18	·19	·26	·26	
3	·11	·09	·09	·07	·01	·06	·08	·05	·07	·04	·07	·05	·04	·05	·02	..	·02	·02	·03	·05	·05	·06	·01	·02	
4	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·03	..	..	..	..	..	
5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
7	·02	..	..	·02	..	·05	·05	·03	·04	·05	·06	·04	·02	·03	·01	·05	·11	·05	·06	·05	·07	·07	·05	·04	
8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
9	..	..	..	..	·01	·02	..	..	..	..	..	..	..	·01	..	·01	·01	..	·01	..	..	..	..	..	
10	·13	·13	·06	·01	..	..	·03	·01	·15	·08	·06	·05	..	·02	..	·02	·23	·03	·07	·01	·05	·02	·01	·02	
11	..	..	·01	..	..	..	..	..	..	..	..	·01	..	..	..	·01	.01	..	·01	·01	..	·01	..	..	
12	..	..	..	..	..	..	..	..	·01	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
13	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
14	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	
15	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
16	·04	·02	·01	..	..	..	·03	·05	·03	·04	·03	·07	..	..	..	..	..	·02	..	·02	·03	·03	·01	·02	
17	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
18	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
19	·08	..	·15	·28	·10	·08	·05	·02	·03	·05	·06	·06	·05	·15	·04	·19	·14	·08	·10	·05	·06	·05	·02	·03	
20	·15	·08	·02	·05	·11	..	·02	·08	·20	·03	·10	·14	·02	·53	·22	·28	·19	·05	·07	·11	·03	·03	·03	·04	
21	20	·41	·22	·36	·85	·30	·45	·23	·11	·20	·26	·22	·14	·09	·32	·24	·53	·32	·32	·32	·43	·56	1·05	·39	
22	06	·06	·07	·08	·02	·05	·05	·01	·02	..	..	·02	..	..	..	·01	·01	·01	·02	..	·02	·01	·01	·01	
23	01	..	..	..	..	..	..	·01	·01	·05	·02	·04	·03	·04	·02	·05	·04	·03	·04	·02	..	·02	·02	·03	
24	..	..	..	·01	..	..	..	..	..	..	·01	..	..	..	..	..	..	·01	·01	..	..	..	..	..	
25	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
26	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	
27	·23	·22	·22	·20	·20	·24	·25	·22	·20	·17	·19	·20	·17	·21	·19	·23	·21	·17	·16	·19	·23	·25	·21	·21	
28	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	
29	77	·75	·71	·64	·65	·75	·80	·83	·84	·94	1·00	·94	·85	·94	1·00	1·02	·98	·92	·78	·91	·87	·99	·86	·88	
30	·07	·08	·02	·05	·04	..	·07	·05	·13	·19	·10	·18	·20	·14	·15	·20	·10	·12	·15	·10	·03	·02	·05	·07	
Total	2.12	2·05	1·75	1·87	2·09	1·72	2·05	1·78	2·09	2·13	2·22	2·26	1·73	2·42	2·25	2·58	2·88	2·05	2·02	2·03	2·08	2·34	2·62	2·06	
From Jan. 1	18·82	18·98	15·84	17·62	17·63	17·43	18·61	14·64	16·36	16·61	16·63	17·88	12·72	13·24	14·32	17·11	16·31	15·29	14·60	16·06	16·59	17·45	14·40	15·13	

Daily Rainfall. *The 50 years (1841–90) mean at Greenwich for October is 2·81 in.* October, 1892.

Day of Month	Dorking	Caterham	Caterham Valley	Marden Park	Kenley	Purley (Reedham)	Purley (Tudor C.)	Ashtead	Oxshott	Banstead	Sutton	Carshalton	Wallington	Bedding-ton	Waddon	Croydon (Brim. Bn.)	Croydon (Whitgift)	Addiscmb. (Hvlk. Rd.)	Addiscmb. (Outm. Rd.)	Addington Hills	Addington (Park Fm.)	Addington (Pump. St.)	West Wickham	Hayes Common	Keston (Bradfield
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·42	·31	·32	·37	·31	·36	·36	·36	·37	·42	·36	·36	·38	·38	·38	·35	·39	·32	·32	·38	·41	·37	·48	·39	·42
2	·15	..	·17	·19	·17	·17	·22	·22	·16	·29	·30	·24	·28	·23	·22	·22	·20	·24	·22	·25	·20	·18	·21	·16	·24
3	·02	..	..	·01	·03	·02	·02	·19	..	..	·02	·01	·03	·01	·02	..	·02	·02	·01	·02	·11	..	·06	·03	·01
4	·50	·57	·60	·59	·53	·53	·58	·42	·39	·54	·54	·54	·53	·52	·49	·55	·56	·56	·55	·58	·58	·60	·60	·62	·61
5	..	·02	..	·02	·02	·01	·03	·01	..	..	·05	..	..	..	..	..	..	..	..	·01	·11	·01	·02	·02	·01
6	·04	·07	·12	·07	·07	·07	·08	·08	·07	·03	..	·05	·05	·06	·06	·08	·06	·08	·07	·08	·08	·09	·12	·11	·12
7	·03	·06	..	·05	·03	·02	·07	·01	..	·05	·03	·02	·01	·02	·02	·03	·01	·01	·01	·06	·11	·05	·02	·08	·02
8	·11	·21	·30	·17	·17	·17	·16	·10	·08	·11	·13	·09	·13	·12	·12	·13	·11	·13	·13	·16	·14	·15	·14	·13	·12
9	·05	·02	..	·03	·04	·05	·05	·08	·07	·02	·04	·06	·04	·05	·06	·06	·10	·07	·07	·04	·04	·03	·04	·11	..
10	..	·01	·06	·01	·03	·04	·03	·01	..	..	·02	..	..	..	..	..	..	..	..	·01	·01	·01	·02	..	·03
11	..	..	..	..	..	..	·02	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	·01	..
12	..	..	·05	·02	·06	·05	·04	·02	·03	..	·02	·01	..	..	..	..	..	..	·01	·06	..	·03	..	·04	·03
13	·25	·39	·30	·28	·24	·26	·26	·18	·17	·20	·21	·23	·22	·23	·24	·24	·26	·27	·45	·28	·28	·27	·36	·26	·30
14	·13	·02	·02	..	·01	..	·01	·04	·05	·02	·03	..	·01	·01	..	·02	·01	·01	·01	·02	·01	·01	·01	..	·01
15	·02	·02	..	..	·02	..	·05	·02	·03	·02	·09	·07	·15	·10	·11	·04	·04	·03	·03	·05	..	·01	..	·06	..
16	·09	..	·15	·10	·09	·11	·06	·03	·02	·04	·05	·04	·05	·05	·05	·06	·06	·05	·05	·06	·06	·07	·08	·06	·10
17	..	..	..	·02	·02	·03	·03	·02	·03	·02	·03	·01	·01	·03	·03	·04	·03	·01	·01	·01	·01	·02	·02	..	·03
18	..	..	..	..	..	·01	·02	·01	..	..	·01	·01	·01	..	..	..	·02	·01	·01	..	..	·01	..	·01	..
19	..	·12	..	..	·01	..	..	·01	..	..	..	·01	·01	·02	·02	..	·02	·02	·01	·02	..	..	..	·01	·01
20	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	·03	..	..	..	..	·01	..	..	..	..
21	..	..	..	·01	..	·01	..	..	·02	..	..	..	·01	..	·02	·06	·06	·06	·06	·03	·03	·01	..	·08	·05
22	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
23	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	..	·02
24	..	..	..	·02	·03	·02	·02	·02	·03	·01	·02	..	·01	·01	·02	..	·01	·01	·01	·02	..	·01	..	·02	·05
25	·06	·04	·10	..	·03	·03	..	·03	·03	·02	·02	..	·02	·03	..	·04	·03	·03	·03	·04	..	·03	·06	..	..
26	..	..	..	·04	·01	..	·05	·01	..	..	..	·02	..	..	·03	..	..	·01	..	..	..	·01	..	·03	..
27	·89	·58	·50	..	·62	·54	·55	·56	·45	·52	·48	·39	·50	·49	·40	·40	·44	·41	·42	·47	·47	·46	·42	·37	·41
28	·50	·61	·56	1·22	·52	·40	·43	·33	·30	·30	·28	·28	·38	·37	·32	·33	·33	·34	·33	·44	·55	·62	·66	·38	·57
29	·02	·11	·06	·03	06	·04	·03	·24	·25	·03	·02	..	..	..	·01	..	·01	·01	·02	·06	·15	·17	·06	·12	·04
30	1·07	1·07	·90	1·11	1·11	1·14	1·27	1·13	1·10	1·56	1·44	1·37	1·37	1·34	1·30	1·22	1·36	1·37	1·35	1·36	1·15	1·22	1·30	1·20	1·31
31	·08	·19	·15	·14	·14	·16	·16	·07	·06	·10	·10	·07	·13	·11	·11	·10	·14	·14	·15	·20	·23	·19	·27	·22	·28
Total	4·43	4·42	4·36	4·51	4·37	4·24	4·60	4·20	3·71	4·30	4·29	3·88	4·33	4·18	4·03	4·00	4·27	4·23	4·33	4·71	4·74	4·63	4·95	4·52	4·79
From Jan. 1	21·14	23·58	23·12	22·79	23·22	21·43	23·21	19·91	18·12	19·76	20·06	19·63	20·70	20·32	19·48	20·22	21·42	21·41	21·25	21·72	23·16	22·21	23·83	22·75	22·64

Daily Rainfall. *The 50 years (1841–90) mean at Greenwich for October is 2·81 in.* October, 1892.

Day of Month	Keston (Heathfld.)	Keston (Tow. Fds.)	Orpington	Farning-ham Hill	Wilming-ton	Chislehurst	Bickley	Beckenham	South Norwood	Wimbledon (Sew. Wks.)	Wimbledon (Mt. Ararat)	Raynes Park	New Malden	Esher	Surbiton	Kingston	Richmond	Brixton	Wandswth. Common	West Norwood	Forest Hill Dartmh.rd.	Forest Hill (Nurseries)	Deptford	Greenwich	Woolwich
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	41	·42	·46	·32	·26	·59	·40	·31	·27	·41	·46	·14	·37	·23	·34	·42	·35	·41	·36	·39	·36	·40	·39	·38	GAUGE STOLEN. RECORD CEASED.
2	·26	·25	·20	·17	·13	·06	·20	·20	·24	·18	·18	·21	·15	·13	·12	·14	·21	·20	·17	·22	·18	·25	·21	·22	
3	·02	·02	·02	..	·01	·03	·02	·01	·01	·01	·01	·02	..	..	..	·01	·02	·01	·02	·01	·02	·01	·01	·02	
4	·61	·59	·65	·74	·69	·64	·65	·54	·58	·47	·54	·46	·41	·34	·39	·42	·37	·50	·49	·57	·56	·58	·51	·51	
5	·02	·10	·02	·06	·01	·02	·02	·01	·09	..	·01	·01	..	·02	..	..	..	..	·01	..	·02	·03	..	..	
6	·12	·11	·11	·17	·20	·13	·13	·08	..	·06	·07	·07	·07	·09	·11	·06	·05	·06	·05	·07	·10	·10	·10	·11	
7	·03	·03	·03	·15	·02	·10	·06	·01	·01	..	..	·01	..	..	..	·01	·02	..	·01	..	..	·03	..	·01	
8	·15	·11	·13	·11	·14	·17	·17	·13	·17	·11	·13	·13	·03	·07	·10	..	·15	·13	·14	·16	·19	·16	·16	·17	
9	·04	·07	·06	·08	·12	·18	·15	·12	·15	·06	·09	·17	·16	·08	·10	·18	·27	·23	·10	·07	·08	·09	·21	·16	
10	..	..	..	·01	..	..	·02	·01	..	..	·01	..	..	..	..	..	..	·01	·01	..	..	..	·01	·02	
11	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
12	·04	..	·02	·03	..	·05	·06	..	..	·02	·01	·02	·02	..	·02	·01	·02	·01	·01	·02	·02	..	·01	·01	
13	·30	·32	·24	·29	·25	·21	·26	·21	·24	·27	·30	·27	·23	·17	·22	·30	·30	·26	·26	·28	·24	·22	·21	·23	
14	..	·01	·02	·04	..	..	·02	..	..	..	·01	·02	..	·03	..	..	·01	..	·02	..	..	·05	..	..	
15	..	·02	·01	·02	..	..	..	..	·02	..	·02	·02	..	·02	..	·02	.01	..	·01	·01	..	..	..	..	
16	·11	·09	·12	·11	·03	·08	·07	·06	·05	..	..	·02	·01	..	·02	·01	·01	·01	·02	·03	·24	·04	..	·01	
17	·03	·01	..	..	..	..	·03	·01	·01	·05	..	·03	..	·02	..	·04	·02	..	·02	·02	..	·01	·01	·02	
18	..	..	..	·01	..	..	..	..	·01	..	·03	..	..	..	..	..	..	..	..	..	·01	..	..	..	
19	·02	..	·01	·01	·01	..	·03	·02	·01	·02	·02	·02	·02	..	·02	·02	·03	·01	·03	·02	·02	·02	..	·01	
20	..	·01	..	..	..	·03	·01	..	..	..	..	·01	..	..	..	..	..	..	·01	..	..	·01	..	..	
21	·05	·07	·07	·03	..	·03	·03	·02	·09	·10	·11	·09	·04	..	·03	·10	·04	·03	·02	·03	·01	·02	..	·01	
22	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	
23	·02	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
24	·04	..	..	·01	..	..	·03	..	·01	..	..	·01	..	·03	..	·01	·02	..	·01	..	..	..	..	..	
25	·05	·06	·04	·04	·04	..	·05	·03	·03	..	·05	·04	·02	·01	·02	·02	·02	·03	·03	·03	..	·04	·02	·03	
26	..	..	..	..	..	..	..	..	·01	·04	..	..	..	·02	..	·01	·02	·02	·05	·01	·01	..	·01	·02	
27	·44	·40	·34	·30	·15	·31	·30	·26	·36	·35	·42	·36	·28	·19	·45	·40	·41	·33	·34	·37	·31	·29	·21	·22	
28	·61	·56	·59	·69	·39	·41	·40	·24	·28	·25	·28	·27	·23	·22	·25	·34	·34	·32	·23	·25	·09	·35	·24	·24	
29	·05	·05	..	·11	·02	·07	·12	·01	..	·21	·19	·25	·14	·05	·07	·05	·03	·18	·19	..	..	·01	..	..	
30	1·28	1·27	1·21	1·28	1·30	1·22	1·38	1·19	1·34	1·21	1·41	1·25	1·05	·46	1·10	1·23	1·13	1·27	1·15	1·33	1·48	1·39	1·30	1·29	
31	·26	·26	.31	·30	·49	·10	·24	·10	·08	·06	·11	·09	·05	·02	·04	·03	·03	·05	·04	·14	·15	·22	·11	·14	
Total	4·97	4·83	4·66	5·08	4·06	4·43	4·85	3·57	4·06	3·88	4·46	4·00	3·28	2·30	3·40	3·83	3·88	4·07	3·80	4·03	4·09	4·32	3·72	3·83	
From Jan. 1	23·79	23·99	20·50	22·70	21·69	21·86	23·46	18·21	20·42	20·49	21·09	21·88	16·00	15·54	17·72	20·94	20·19	19·36	18·40	20·09	20·68	21·77	18·12	18·96	

Daily Rainfall. *The 50 years (1841–90) mean at Greenwich for November is 2·27 in.* **November, 1892**

Day of Month	Dorking	Caterham	Caterham Valley	Marden Park	Kenley	Purley (Reedham)	Purley (Tudor C.)	Ashtead	Oxshott	Banstead	Sutton	Carshalton
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	..	..	..	..	..	..	..	..	..	..	..
2	·21	·24	·22	·20	·16	·13	·12	·13	·11	·09	·10	·09
3	·03	..	·12	·03	·02	·03	·04	·02	·02	·02	·02	·02
4	·44	·47	·30	·47	·48	·37	·42	·27	·22	·29	·33	·26
5	·38	·17	·10	·10	·09	·10	·13	·18	·25	·20	·15	·16
6	·07	..	·03	·03	·03	·02	·05	·11	·08	·05	·06	·01
7	..	..	..	..	·01	..	..	..	..	·01	..	·01
8	..	..	..	·01	..	..	..	..	..	..	·02	..
9	..	..	..	..	..	..	..	..	..	..	..	..
10	..	..	..	..	..	..	·01	..	..	..	..	..
11	·02	..	..	·01	·02	·03	·01	·02	·03	·02	·04	·03
12	..	·03	..	·01	·02	·02	·02	·03	·02	·01	·01	·02
13	·08	·04	..	·02	·02	·03	·04	·06	·05	·04	·04	·03
14	·07	·03	·10	·02	·02	..	·03	·05	·05	·06	·02	·01
15	·80	·80	·71	·82	·73	·66	·60	·76	·63	·62	·64	·73
16	·50	·66	·65	·66	·58	·63	·65	·49	·47	·58	·54	·48
17	..	..	·12	·01	..	..	..	..	..	..	..	..
18	..	..	..	..	..	..	·02	..	..	..	..	·01
19	·06	..	..	·06	·03	..	..	·07	·10	·02	·06	·05
20	..	..	..	..	..	..	..	..	..	..	..	..
21	..	·06	..	..	..	..	..	·02	·01	..	..	·01
22	..	..	..	..	..	..	..	..	..	..	..	..
23	·15	·15	..	·14	·14	·19	·12	·11	·10	·12	·15	·12
24	..	·04	·12	·05	·05	·06	·07	·01	·01	·02	·04	·04
25	·07	..	..	..	..	..	·02	·03	·03	..	·06	·04
26	·40	·36	·35	·30	·33	·34	·34	·28	·25	·32	·23	·25
27	..	..	·08	·01	..	..	..	·01	..	..	..	·01
28	..	·01	..	..	..	..	..	..	..	..	..	..
29	·14	..	..	·05	·09	·08	·09	·09	·08	·11	·10	·09
30	..	·09	..	..	..	..	..	..	..	..	..	·01
Total	3·42	3·15	2·90	3·00	2·82	2·69	2·78	2·74	2·51	2·58	2·61	2·48
From Jan. 1	24·56	26·73	26·02	25·79	26·04	24·12	25·99	22·65	20·63	22·34	22·67	22·11

Day of Month	Wallington	Beddington	Waddon	Croydon (Brim. Bn.)	Croydon (Whitgift)	Addiscmb. (Hvlk. Rd.)	Addiscmb. (Outm. Rd.)	Addington Hills	Addington (Park Fm.)	Addington (Pump. St.)	West Wickham	Hayes Common	Keston (Bradfield
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	..	..	..	..	·01	..	·01	..	·01	..	..	..
2	·09	·09	·07	·09	·08	·08	·08	·10	·10	·11	·12	·11	·10
3	·03	·03	·02	·03	·02	·01	·02	·02	·02	·02	·03	·02	·03
4	·34	·32	·30	·31	·32	·30	·30	·36	·38	·39	·44	·35	·39
5	·14	·10	·10	·10	·07	·09	·09	·10	·06	·11	·08	·07	·06
6	·04	·03	·03	·04	·06	·02	·02	·02	·02	·03	·02	·02	·01
7	..	..	..	..	..	·01	·01	·01	..	·01	..	..	..
8	·01	..	·01	..	..	..	..	..	..	..	·02	·01	·01
9	..	..	..	..	..	..	..	..	..	..	..	..	..
10	..	..	..	..	..	·01	..	·01	..	..	..	..	..
11	·04	·08	..	·02	·02	·01	·01	·01	·02	·02	·02	·05	·06
12	·02	·02	·02	..	·02	·01	·01	·02	..	..	..	..	·01
13	·02	·02	·01	..	..	·01	·01	·02	·01	·01	·01	..	·01
14	·03	·02	·01	·04	·02	·01	·01	·01	·01	·01	·02	·02	·01
15	·61	·60	·54	·59	·57	·56	·55	·71	·56	·61	·68	·59	·63
16	·58	·57	·58	·58	·64	·66	·67	·69	·80	·66	·91	·71	·84
17	..	..	..	..	..	..	..	..	..	..	..	..	..
18	·01	..	..	..	..	·01	..	..	..	..	..	..	..
19	·05	·06	·07	·09	·09	·07	·07	·08	..	·02	·03	·08	·05
20	..	..	..	..	..	..	..	..	..	·01	..	..	..
21	·01	..	..	..	..	·01	..	..	·01	..	..	·01	..
22	..	..	..	..	..	..	..	..	..	..	..	..	..
23	·13	·12	·12	·12	·13	·12	·10	·10	·08	·11	·10	·08	·08
24	·05	·05	·05	·06	·07	·05	·04	·06	·04	·05	·06	·05	·05
25	·03	·02	·02	·02	·02	·01	·01	·01	..	·01	..	..	·01
26	·24	·25	·25	·28	·28	·27	·26	·29	·28	·31	·34	·27	·27
27	..	..	·01	..	..	..	..	..	..	..	..	..	..
28	..	..	..	..	..	..	..	..	..	..	..	..	..
29	·10	·10	·09	·10	·09	·09	·09	·09	·09	·09	·06	·10	·07
30	..	..	·01	..	..	..	..	..	..	..	..	..	..
Total	2·57	2·48	2·31	2·47	2·50	2·42	2·35	2·72	2·48	2·59	2·94	2·54	2·69
From Jan. 1	23·27	22·80	21·79	22·69	23·92	23·83	23·60	24·44	24·64	24·80	26·77	25·29	25·33

Daily Rainfall. *The 50 years (1841–90) mean at Greenwich for November is 2·27 in.* November, 1892.

Day of Month	Keston (Heathfld.)	Keston (Tow. Fds.)	Orpington	Farningham Hill	Wilmington	Chislehurst	Bickley	Beckenham
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·01	..	·01	..	..	..	..	..
2	·11	·10	·09	·12	·08	·09	·11	·06
3	·04	..	·02	·02	·01	..	·04	·01
4	·45	·45	·39	·25	·18	·29	·28	·18
5	·06	·06	·07	·08	·10	·06	·07	·07
6	·03	·02	·01	·05	..	..	·03	..
7	..	..	..	·01	·01	..	·02	·02
8	..	..	..	·01	..	..	..	..
9	..	..	..	..	..	..	..	..
10	·01	..	..	·01	..	..	·02	..
11	·06	·10	·10	·12	·08	·16	·16	·07
12	..	·01	..	·01	..	..	·02	·01
13	·03	·02	..	·01	..	..	·01	..
14	·02	..	·03	·03	..	·02	·01	..
15	·75	·67	·96	·75	·94	·60	·61	·52
16	·70	·81	·79	·84	·81	·71	·92	·60
17	..	..	..	·01	..	..	..	..
18	·01	..	..	..	·01	..	·02	..
19	·05	·06	·03	·03	·03	·07	·08	·06
20	..	..	..	..	..	..	·01	..
21	..	..	..	..	..	..	..	..
22	..	..	..	..	..	..	..	..
23	·09	·10	·06	·08	·08	·11	·10	·07
24	·06	·06	·02	·03	·01	..	·04	·03
25	·01	..	·01	..	..	..	·03	..
26	·30	·29	·29	·28	·26	·32	·30	·25
27	·01	..	..	..	..	·01	·01	..
28	..	..	..	·01	..	..	..	..
29	·08	·08	·07	..	·07	·09	·09	·07
30	..	..	..	·05	..	..	..	..
Total	2·88	2·83	2·95	2·80	2·67	2·53	2·98	2·02
From Jan. 1	26·67	26·82	23·45	25·50	24·36	24·39	26·44	20·23

Day of Month	South Norwood	Wimbledon (Sew. Wks.)	Wimbledon (Mt. Ararat)	Raynes Park	New Malden	Esher	Surbiton	Kingston
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·01	..	..	·02	..	..	..	·01
2	·08	·15	·15	·13	·14	·15	·14	·13
3	·01	·01	·19	·03	..	·02	..	·01
4	·25	·14	·08	·16	·13	·16	·13	·18
5	·08	·21	·26	·22	·15	·09	·13	·20
6	·03	·06	·08	·08	·08	·07	·05	..
7	·01	..	..	·02	..	·02	..	..
8	..	..	..	·02	..	·01	..	..
9	..	..	..	..	..	..	..	..
10	..	..	..	·01	..	..	..	..
11	·01	·05	·09	·08	..	..	..	·01
12	·01	..	·01	·02	..	·02	..	·02
13	·01	·04	·05	·05	·04	·04	·07	·03
14	·01	·03	·05	·08	·01	·03	..	·03
15	·58	·75	·75	·72	·60	·85	·72	81
16	·58	·52	·57	·55	·50	·42	·55	·64
17	..	..	..	..	..	..	..	..
18	..	..	·01	·02	..	..	..	..
19	·07	·07	·09	·10	·11	·13	·11	·10
20	..	..	·01	·01	..	·02	..	..
21	..	..	..	..	..	..	..	..
22	..	..	..	..	..	..	..	..
23	·09	·07	·09	·10	·09	·09	·08	·08
24	·04	·04	·04	·05	·02	·03	..	·02
25	·01	·01	·03	·04	..	·06	·01	·03
26	·15	·28	·30	·32	·30	·27	·29	·33
27	..	..	..	..	..	..	..	..
28	..	..	..	..	..	..	..	..
29	·09	·10	·13	·12	·09	·07	·09	·09
30	..	..	..	..	..	..	..	..
Total	2·12	2·53	3·00	2·95	2·26	2·55	2·37	2·72
From Jan. 1	22·54	23·02	24·09	24·83	18·26	18·09	20·09	23·66

Day of Month	Richmond	Brixton	Wandswth. Common	West Norwood	Forest Hill Dartmh. rd.	Forest Hill (Nurseries)	Deptford	Greenwich	Woolwich
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·01	..	·02	..	·02	·01	..	..	GAUGE STOLEN. RECORD CEASED.
2	·14	·18	·13	·12	·13	·13	·16	·18	
3	.01	·01	·01	·01	..	·04	..	·01	
4	·19	·14	·14	·18	·10	·18	·11	·12	
5	·24	·15	·25	·12	·06	·06	·05	·07	
6	·02	·06	·02	·03	..	·03	·01	·01	
7	·01	..	·02	·01	..	·01	..	·01	
8	..	·01	..	..	..	·01	..	..	
9	..	..	..	..	..	..	..	..	
10	·01	..	..	..	..	..	..	·01	
11	·10	·08	·03	..	·08	·12	·09	·09	
12	·03	·03	·02	·04	..	·02	·01	·02	
13	·03	·03	·04	·03	·05	·03	·02	·02	
14	·03	·01	·02	·01	·02	..	..	..	
15	·94	·67	·74	·67	·62	·60	·59	·63	
16	·53	·53	·47	·52	·56	·63	·49	·51	
17	..	..	·01	..	..	..	..	..	
18	..	..	..	..	·02	..	..	·01	
19	·10	·07	·07	·05	·06	·12	·08	·09	
20	..	..	..	..	..	..	..	..	
21	·01	..	..	·01	..	·01	..	..	
22	..	..	..	..	·02	..	..	..	
23	·04	·06	·06	·06	·06	·06	·05	·05	
24	·02	·02	·04	·04	·04	·03	·04	·04	
25	·02	..	·01	·01	..	..	..	..	
26	·32	·29	·29	·31	·30	·30	·26	·27	
27	·01	..	..	..	..	..	..	..	
28	..	..	·01	..	..	..	..	..	
29	·08	·08	·08	·11	·10	·10	·07	·07	
30	..	..	..	..	..	..	..	..	
Total	2·89	2·42	2·48	2·33	2·24	2·49	2·03	2·21	
From Jan. 1	23·08	21·78	20·88	22·42	22·92	24·26	20·15	21·17	

Daily Rainfall. *The 50 years (1841–90) mean at Greenwich for December is 1·77 in.* **December, 1892.**

Day of Month	Dorking	Caterham	Caterham Valley	Marden Park	Kenley	Purley (Reedham)	Purley (Tudor C.)	Ashtead	Oxshott	Banstead	Sutton	Carshalton	Wallington	Bedding-ton	Waddon	Croydon (Brim. Bn.)	Croydon (Whitgift)	Addiscmb. (Hvlk. Rd.)	Addiscmb. (Outm. Rd.)	Addington Hills	Addington (Park Fm.)	Addington (Pump. St.)	West Wickham	Hayes Common	Keston (Bradfield
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·48	·50	OBSERVATIONS DISCONTINUED OWING TO ILLNESS.	·44	·37	·33	·37	·32	·33	·33	·35	OBSERVER DEAD. RECORD CEASED.	·33	·33	·30	·32	·34	·33	·33	·34	·34	·36	·40	·25	·28
2	·28	·35		·31	·22	·21	·20	·15	·14	·22	·13		·14	·14	·14	·14	·14	·14	·14	·16	·10	·19	·21	·28	·18
3	·22	·20		·12	·18	·17	·17	·14	·12	·16	·12		·13	·12	·12	·12	·13	·13	·11	·14	·21	·18	·19	·13	·17
4	..	..		..	..	..	..	..	..	·09	..		..	..	..	..	..	..	..	..	..	..	..	·02	..
5	·16	..		..	·01	·01	·03	·13	·02	·06	·05		·01	..	..	..	·01	..	..	..	..	..	..	..	..
6	..	..		·07	·09	·07	·08	·04	·07	·03	·06		·08	·09	·09	·08	·08	·10	·10	·10	·16	·15	·21	·17	·20
7	..	..		..	..	..	..	..	..	..	..		..	..	..	..	..	..	..	..	..	..	..	·02	..
8	·31	·50		·41	·36	·31	·35	·28	·27	·31	·29		·32	·33	·30	·30	·31	·27	·27	·29	·40	·35	·40	·38	·35
9	..	..		..	..	..	..	·01	..	..	..		..	..	..	..	..	..	..	..	..	..	..	..	..
10	·25	·32		·25	·21	·15	·17	·12	·11	·14	·13		·13	·13	·11	·12	·13	·11	·12	·13	·16	·15	·18	·14	·14
11	..	·04		..	·02	·01	..	·02	..	..	·06		..	..	..	..	..	·01	..	..	..	..	..	·01	·01
12	·15	·05		·11	·05	·05	·08	·16	·10	·07	..		·05	·04	·04	·05	·04	·04	·03	·04	·04	·04	..	..	·03
13	·08	·10		·07	·06	·04	·05	·05	·03	·05	·04		·04	·05	·05	..	·03	·03	·04	·04	·04	·05	..	·07	·07
14	·10	·13		·08	·09	·09	·11	·10	·07	·07	·08		·10	·09	·08	·11	·08	·08	·08	·08	·10	·08	·17	·07	·05
15	..	..		..	·01	..	..	·01	..	..	..		..	..	..	..	..	·01	..	..	..	..	..	..	..
16	..	..		..	·01	..	..	..	..	..	..		..	..	..	..	..	..	..	..	..	..	..	..	..
17	..	..		..	..	..	..	..	..	..	..		..	..	..	..	..	..	..	..	..	..	..	..	..
18	..	..		..	..	..	..	..	..	..	..		..	..	..	..	..	..	..	..	..	..	..	..	..
19	..	..		..	..	..	..	..	..	..	..		..	..	..	..	..	..	..	..	..	..	..	..	..
20	..	..		..	..	..	..	..	..	..	..		..	..	..	..	..	..	..	..	..	..	..	..	..
21	..	..		..	..	..	..	..	..	..	..		..	..	..	..	..	..	..	..	..	..	..	..	..
22	..	..		..	..	..	..	..	..	..	..		..	..	..	..	..	..	..	..	..	..	..	..	..
23	..	..		..	..	..	..	..	..	..	..		..	..	..	..	..	·01	..	..	..	..	..	..	..
24	..	..		..	..	..	..	..	..	..	..		..	..	..	..	..	..	..	..	..	..	..	..	..
25	..	..		..	..	..	..	..	..	..	..		..	..	..	..	..	..	..	..	..	..	..	..	..
26	..	..		..	..	..	..	..	..	..	..		..	..	..	..	..	..	..	..	..	..	..	..	..
27	..	..		..	..	..	..	..	..	..	..		..	..	..	..	..	..	..	..	..	..	..	..	..
28	..	..		..	..	..	..	..	..	..	..		..	..	..	..	..	..	..	..	..	..	..	..	..
29	..	..		..	..	..	..	..	..	..	..		·01	..	..	..	..	·02	..	..	..	..	..	..	..
30	..	..		..	..	..	..	..	..	..	..		..	..	..	..	..	..	..	..	..	..	..	..	..
31	..	..		·04	·03	·06	..	·01	·01	..	·01		·05	·01	·03	..	..	·03	..	·04	·05	·04	..	·03	·07
Total	2·03	2·19		1·90	1·71	1·50	1·61	1·54	1·27	1·53	1·32		1·39	1·33	1·26	1·24	1·29	1·31	1·22	1·36	1·60	1·59	1·76	1·57	1·55
From Jan. 1	26·59	28·92		27·69	27·75	25·62	27·60	24·19	21·90	23·87	23·99		24·66	24·13	23·05	23·93	25·21	25·14	24·82	25·80	26·24	26·39	28·53	26·86	26·88

Daily Rainfall. *The 50 years (1841–90) mean at Greenwich for December is 1·77 in.* **December, 1892.**

Day of Month	Keston (Heathfd.)	Keston (Tow. Fds.)	Orpington	Farning-ham Hill	Wilming-ton	Chislehurst	Bickley	Beckenham	South Norwood	Wimbledon (Sew. Wks.)	Wimbledon (Mt. Ararat)	Raynes Park	New Malden	Esher	Surbiton	Kingston	Richmond	Brixton	Wandswth. Common	West Norwood	Forest Hill Dartmth. rd.	Forest Hill (Nurseries)	Deptford	Greenwich	Woolwich
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·30	·35	·34	·31	·34	·37	·37	·31	·31	·29	·33	·35	·28	·33	·30	·37	·33	·36	·34	·37	·34	·39	·35	·36	
2	·19	·15	·17	·15	·18	·17	·15	·14	·13	·10	·16	·14	·08	·09	·09	·12	·11	·12	·13	·14	·11	·13	·09	·11	
3	·18	·20	·21	·20	·11	·14	·16	·11	·10	·11	·11	·11	·09	·09	·08	·10	·10	·09	·09	·10	·12	·13	·09	·08	
4	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
5	..	..	..	·01	..	..	·02	..	..	·01	..	·02	·03	·10	·07	·06	·03	·01	·01	..	..	..	..	..	
6	·21	·22	·21	·21	·24	·20	·24	·11	·09	·06	·09	·07	..	·04	·04	·06	·05	·08	·08	·09	·10	·13	·12	·12	
7	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
8	·40	·38	·37	·30	·16	·21	·25	·20	·24	·25	·29	·31	·29	·19	·27	·31	·28	·23	·26	·23	·14	·25	·24	·20	
9	..	..	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
10	·15	·14	·12	·10	·07	·10	·10	·09	·10	·10	·10	·11	·09	·11	·11	·12	·12	·14	·12	·11	·12	·11	·13	·13	
11	·01	..	..	..	..	..	·01	·01	·01	..	..	·01	..	..	..	·01	·01	..	·01	·01	..	·01	..	..	
12	..	·03	..	·02	..	..	..	·03	..	..	·05	·03	·04	·05	·04	·05	·04	..	·04	·03	..	..	..	·01	
13	·05	·05	·04	·05	·06	·08	·08	·04	·04	·06	·04	..	..	·04	..	·05	·04	·06	·04	·05	·11	·07	·04	·05	
14	·07	·08	·06	·05	·04	·08	·07	·07	·09	·10	·09	·10	·06	·06	·08	·10	·09	·11	·10	·10	·06	·11	·09	·08	
15	..	..	..	..	..	..	..	..	..	..	..	..	..	·02	..	..	..	..	·01	..	..	..	..	..	
16	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	GAUGE STOLEN. RECORD CEASED.
17	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
18	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
19	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
21	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	..	..	
22	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
23	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
24	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
25	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
26	..	..	..	..	..	..	..	..	..	..	..	·02	..	..	..	..	..	..	..	..	..	..	..	..	
27	..	..	..	..	..	..	·03	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
28	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	
29	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
30	·02	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
31	·03	·05	·06	·08	·06	·18	·12	·05	·05	..	..	..	..	..	..	..	·01	..	..	·02	·04	..	..	·04	
Total	1·61	1·65	1·58	1·49	1·26	1·53	1·61	1·16	1·16	1·08	1·27	1·27	·96	1·12	1·08	1·35	1·22	1·20	1·23	1·25	1·14	1·33	1·15	1·18	
From Jan. 1	28·28	28·47	25·03	26·99	25·62	25·92	28·05	21·39	23·70	24·10	25·36	26·10	19·22	19·21	21·17	25·01	24·30	22·08	22·11	23·67	24·06	25·59	21·30	22·35	

APPENDIX III.

MONTHLY RECORDS.

STATION.	Jan.	Feb.	Mar.	Apr.	May	Jun.	July	Aug.	Sep.	Oct.	Nov.	Dec.	Year.
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
Knockholt..	0·74	1·35	1·27?	1·18	1·35	4·63	2·07	3·65	3·39	4·60	3·42	2·47	30·12
Coulsdon ..	0·42	1·21	1·13	1·11	1·20	3·48	1·85	3·59	2·41	4·17	2·81	1·55	24·93
Croydon (Waddon New Rd.)	0·45	1·59	1·48	1·32	1·19	2·84	2·18	3·09	2·06	3·93	2·32	1·28	23·73
Croydon (Oakfield Rd.)	0·41	1·45	1·11	1·28	1·18	2·94	2·16	3·25	1·96	3·82	2·23	1·24	23·03

APPENDIX IV.

Falls of 1·0 in. and upwards.

May 25th.

Forest Hill (Dartmouth Road), 1·13 in.; Addington Hills, 1·08 in.; Deptford, 1·05 in.; Kenley, 1·03 in.; Raynes Park, 1·02 in.; Greenwich, 1·01 in.; Banstead, Wimbledon (Sewerage Works), and Wimbledon (Mount Ararat), 1·00 in.

June 28th.

Caterham Valley, 2·50 in.; Caterham, 2·45 in.; Marden Park, 2·12 in.; West Wickham and Farningham Hill, 1·95 in.; Wilmington, 1·93 in.; Addington (Pumping Station), 1·81 in.; Hayes Common, 1·76 in.; Keston (Bradfield), 1·71 in.; Keston (Heathfield), 1·57 in.; Bickley, 1·54 in.; Bromley, 1·52 in.; Keston (Tower Fields) and Chislehurst, 1·45 in.; Orpington, 1·43 in.; Addington (Park Farm) and Wimbledon (Mount Ararat), 1·35 in.; Coulsdon, 1·26 in.; Esher, 1·23 in.; Kingston, 1·19 in.; Raynes Park, 1·11 in.; Richmond, 1·03 in.; Wimbledon (Sewerage Works), 1·02 in.

July 13th.

Wilmington, 1·28 in.

August 27th.

Kingston, 1·85 in.; Surbiton, 1·75 in.; Wimbledon (Mount Ararat), 1·72 in.; Richmond, 1·70 in.; Kenley, 1·66 in.; Dorking and Raynes Park, 1·60 in.; Wandsworth Common and Coulsdon, 1·58 in.; Wimbledon (Sewarage Works), 1·54 in.;

Marden Park, 1·52 in.; Purley (Tudor Cottages), 1·51 in.; New Malden, 1·50 in.; Oxshott, 1·46 in.; Westerham, 1·40 in.; Ashtead, 1·38 in.; West Norwood, 1·32 in.; Chislehurst, 1·30 in.; Esher and Greenwich, 1·26 in.; Carshalton, 1·22 in.; Croydon (Waddon New Road), 1·19 in.; Purley (Reedham Asylum), 1·13 in.; Banstead, 1·12 in.; South Norwood, 1·06 in.; Croydon (Whitgift School) and Forest Hill (Dartmouth Road), 1·04 in.; Addington (Pumping Station), 1·03 in.; Bickley, 1·02 in.

SEPTEMBER 29TH.

Kingston, 1·02 in.; Wimbledon (Mount Ararat) and Surbiton, 1·00 in.

OCTOBER 28TH.

Marden Park, 1·22 in.

OCTOBER 30TH.

Banstead, 1·56 in.; Forest Hill (Dartmouth Road), 1·48 in.; Sutton, 1·44 in.; Wimbledon (Mount Ararat), 1·41 in.; Forest Hill (The Nurseries), 1·39 in.; Bickley, 1·38 in.; Carshalton, Wallington, and Addiscombe (Havelock Road), 1·37 in.; Croydon (Whitgift School) and Addington Hills, 1·36 in; Addiscombe (Outram Road) and Eltham, 1·35 in.; Beddington, South Norwood, and Bromley, 1·34 in.; West Norwood, 1·33 in.; Keston (Bradfield) and Croydon (Waddon New Road), 1·31 in.; Waddon, West Wickham, Wilmington, and Deptford, 1·30 in.; Greenwich, 1·29 in.; Keston (Heathfield) and Farningham Hill, 1·28 in.; Purley (Tudor Cottages), Keston (Tower Fields), and Brixton, 1·27 in.; Raynes Park, 1·25 in.; Kingston, 1·23 in.; Croydon (Brimstone Barn), Addington (Pumping Station), and Chislehurst, 1·22 in.; Orpington, Wimbledon (Sewerage Works), and Croydon (Oakfield Road), 1·21 in.; Hayes Common, 1·20 in.; Beckenham, 1·19 in.; Addington (Park Farm) and Wandsworth Common, 1·15 in.; Purley (Reedham Asylum), 1·14 in.; Ashtead and Richmond, 1·13 in.; Marden Park and Kenley, 1·11 in.; Oxshott and Surbiton, 1·10 in.; Dorking and Caterham, 1·07 in.; New Malden, 1·05 in.; Coulsdon, 1·03 in.

APPENDIX V.

JANUARY.

The month has been a cold and dreary one, but is especially remarkable for its almost total absence of snow, and its exceedingly small rainfall, certainly the smallest for more than thirty years. The month would probably be considered an unhealthy

one, owing to the great amount of sickness about. At Wallington the mean temperature was 36·5°, at Beddington 35·6°, and at Waddon 35·8°, which is about 1° below the mean. Sunlight was deficient, being only 17 per cent. of possible duration at Wallington.

February.

The month has been a changeable one, being very warm at the beginning and end, but very cold from 14th to the 19th, on which latter day the minimum in the shade at both Waddon and Beddington stood respectively at 11·0° and 11·3°, and on the snow at the latter at 2·1°. The mean temperature at Wallington was 39·0°, at Beddington 38·5°, and at Waddon 38·6°, which is about 2° above the mean. Sunlight was again deficient, being only 19 per cent. of possible duration at Wallington.

March.

The month, which was the coldest since 1883, was bright and dry; but owing to the great rain on the 15th, the total rainfall was not above ½ inch below the mean. The mean temperature at Wallington was 38·0°, at Beddington 37·0°, and at Waddon 37·6°, which was about 3° below the mean. A more backward spring had not been known for many years. Sunlight was at Wallington 34 per cent. of possible duration, being 4 per cent. in excess of the mean.

April.

This was an extraordinary month, owing to the great range of temperature, which was 51·1° at Wallington, 49·9° at Beddington, and 48·0° at Waddon. The first half of the month was warm and sunny, but the latter half was cold and rather wet, thus causing everything to be most backward. The mean temperature at Wallington was 47·0°, at Beddington 45·1°, and at Waddon 48·1°. Sunlight at Wallington was 54 per cent. of the possible duration, being no less than 17 per cent. in excess of the mean.

May.

The month, with the exception of the four days in the first week (2nd to 5th inclusive), has been warm, dry, and genial, with a very great range of temperature, which at Wallington amounted to 52·8°, at Beddington to 56·9°, and at Waddon to 56·4°. The mean temperature was about 1° above the mean, and was at Wallington 54·8°, at Beddington 53·8°, and at Waddon 54·2°. Nearly all the rain that fell came down on the 25th, and did an immense good. Sunlight at Wallington was 48 per cent. of the possible duration, and was 5 per cent. in excess of the mean.

June.

The month has been a cool and tolerably wet one, though on the whole rather favourable for out-door occupations. The mean temperature has been rather low, about 1° below the mean, being at Wallington 58·3°, at Beddington 57·1°, and at Waddon 57·6°. Sunlight at Wallington was 48 per cent. of the possible duration, and was 6 per cent. in excess of the mean.

July.

The month has been a cool, dry one, with a great absence of sunlight, and an increase in the amount of cloud. The mean temperature was between 1° and 2° below the mean, and was at Wallington 60·4°, at Beddington 59·3°, and at Waddon 61·5°. Sunlight at Wallington was only 38 per cent. of the possible duration, and was 3 per cent. below the mean.

August.

The month has been a warm, but rather a wet one, more especially in the latter part of it. The mean temperature in the shade was the highest since 1886, and was between 1° and 2° above the mean, being at Wallington 62·5°, at Beddington 61·3°, and at Waddon 62·0°. This high temperature gave rise to a good deal of sickness. Sunlight at Wallington was 47 per cent. of the possible duration, and was 2 per cent. above the mean.

September.

This month is noticeable for its comparatively low means of temperatures, and its freedom from extremes. It was wetter than any September since 1887, and it was not good weather for harvesting, for though the first half was fairly dry, yet there was a want of sun and dry air. The mean temperature is about 1° below the mean, and was at Wallington 57·1°, at Beddington 56·0°, at Waddon 56·6°. Sunlight at Wallington was 40 per cent. of the possible duration, and was 4 per cent. below the mean.

October.

A cold, wet, cloudy month, the coldest since October, 1887; and the frost of the 25th–26th will long be remembered as being especially severe for October. The mean temperature would appear to be between 3° and 5° below the average, and was at Wallington 46·2°, at Beddington 45·1°, and at Waddon 45·3°. There has consequently been a very great deal of illness about. Sunlight at Wallington was only 24 per cent. of the possible duration, being no less than 11 per cent. below the mean.

November.

This month has been a mild, calm, open one, very similar in character to November, 1888. Sickness, especially whooping cough, was very prevalent. At Wallington, on the morning of the 3rd, was seen a very brilliant rainbow, which lasted from 7.3 a.m. to 7.23 a.m., the sun having only risen at 7 a.m. The mean temperature was about 1° above the average, and was at Wallington 44·6°, at Beddington 43·7°, and at Waddon 44·2°. Sunlight was again deficient, and was at Wallington 17 per cent. of the possible duration, being 2 per cent. below the mean.

December.

The month was a cold one, and owing to the nearly total absence of snow the ground was frozen to a great depth. The smallness of the rainfall and the lowness of the temperature will probably account for the large amount of sickness which was prevalent. The mean temperature would appear to be about 1° below the average, and was at Wallington 35·5°, at Beddington 34·7°, and at Waddon 34·9°. Sunlight was again deficient, being at Wallington only 15 per cent. of the possible duration, and 2 per cent. below the mean.

CONTENTS.

Croydon Microscopical and Natural History Club.

OFFICERS FOR 1893.

President.—H. Franklin Parsons, M.D., F.G.S.

Vice-Presidents. — John Berney, F.R.M.S.; Philip Crowley, F.L.S., F.Z.S., &c.; Henry S. Eaton, M.A., F.R. Met. Soc.; Henry T. Mennell, F.L.S.; Henry G. Thompson, M.D., J.P., &c.; Edward Lovett.

Treasurer.—Edward B. Sturge.

Librarian.—F. C. Bayard, LL.M., F.R. Met. Soc.

Committee.—J. Weir Brown; H. C. Collyer; Thos. Cushing, F.R.A.S.; C. H. Goodman; H. D. Gower; W. Murton Holmes; K. McKean, F.L.S.; C. Lanfear; W. Low Sarjeant.

Hon. Secretary.—Thos. D. Aldous, F.R.M.S., 37, St. Peter's Road, Croydon, to whom all communications may be addressed.

PROCEEDINGS & TRANSACTIONS

OF THE

CROYDON MICROSCOPICAL & NATURAL HISTORY CLUB.

FEBRUARY 8, 1893, TO JANUARY 16, 1894.

CROYDON:

PRINTED FOR THE CLUB, BY WEST, NEWMAN & CO., HATTON GARDEN, LONDON.

1894.

PROCEEDINGS

OF

THE CROYDON MICROSCOPICAL AND NATURAL HISTORY CLUB.

1893—94.

Twenty-fourth Annual Meeting.

Held at the Public Hall, Croydon, January 16th, 1894.

H. Franklin Parsons, M.D., F.G.S., President, in the chair.

The Balance-sheet of the accounts for 1893 (p. xliv) was taken as read and passed.

The Treasurer remarked that it would greatly assist matters if members would pay their subscriptions early in the year.

Mr. Mennell proposed the re-election of Dr. Parsons to the office of President for another year. This was seconded by Mr. Crowley, and carried unanimously.

Dr. Parsons thanked the members.

Mr. McKean, seconded by Mr. Holmes, proposed that Mr. Sturge be re-elected Treasurer, and Mr. Aldous, Secretary; and Mr. Roods be elected Librarian.

Messrs. Sturge and Aldous thanked the members for their re-election to their respective offices.

The Secretary said that, no other nominations having been received, the names of Messrs. Drage and Epps would be added to the Committee to fill the two vacancies occurring under the rules, and that the officers of the Club for the ensuing year would be as follows:—

President.—H. Franklin Parsons, M.D., F.G.S.

Vice-Presidents.—John Berney, F.R.M.S.; Philip Crowley, F.L.S., F.Z.S.; Henry S. Eaton, M.A., F.R.Met.Soc.; Henry T. Mennell, F.L.S.; Henry G. Thompson, M.D., J.P., &c.; Edward Lovett.

Treasurer.—E. B. Sturge.

Hon. Secretary.—Thos. D. Aldous, F.R.M.S.

Librarian.—Alfred Roods.

Committee.—J. Weir Brown; H. C. Collyer; J. H. Drage; James Epps, Jun.; C. H. Goodman; Harry D. Gower; W. Murton Holmes; C. Lanfear; W. Low Sarjeant.

The President then delivered his Address, at the conclusion of which a cordial vote of thanks was accorded to him for his address, and for his services during the past year.

The President's Address.

Gentlemen,

The custom of the Croydon Microscopical and Natural History Club—fortunately for your President—does not impose upon him the obligation to search for a subject on which he might attempt to say something original, but limits his annual address to a review of the proceedings of the Club during the past year, with, it may be, some suggestions for its future action. The duty thus imposed upon me I will endeavour to discharge to the best of my ability, and I am glad to be able to congratulate the Club on its continued vitality.

We started the year with a total roll of 281 members. During the year we have lost 30, that is to say, 23 by resignation and 2 by death; while 5 members who have not paid any subscriptions for three years or over have been struck off the list.

During the year we have elected 16 new members, and there are 2 for election this evening; so that our net loss of membership from all causes is 12, and we start this year with a total of 269, comprising 258 ordinary members, 7 honorary members, and 2 associates. It is hoped that members will do what they can to obtain recruits for our ranks. Young men who are interested in natural science will be especially welcome, even though they may not have a profound acquaintance with any branch. An increased membership would benefit the Club financially, and the infusion of new blood would add interest to our meetings. The work of a society like ours is apt to be left too much to the veterans who have already often said their say.

As to accounts. The financial depression of which we have heard so much of late has, I expect, rather affected our Club; the subscriptions for the year having been less than in 1892, *viz.*, £121 against £133 10s., which, however, included some arrears of previous years. I am sorry to say that thirty members have not yet paid their overdue subscriptions; this number compares with 43, 24, 17 for the three preceding years. The sale of Soirée tickets amounted to £20 9s., being about £6 less

than last year; and the donations towards the Meteorological Sub-Committee expenses have been £15 against £22 12s.

Expenses. Printing and postages have been somewhat less, £45 5s. 1d., as compared with £53 5s. 10d.; but we have now an extra room for the Photographic Section, for which £9 rent has been paid this year. The Soirée expenses, as per Balance-sheet, amount to £38 0s. 7d.; with a further payment to be made for tables, £10 18s. 6d. This account was not rendered in time to be included in the accounts. It will be remembered that for the past two years we have been largely indebted to a few members for the reduction in the cost of the Conversazione, while this year it has been entirely borne by the Club. We have also the salary of an Assistant Secretary in this year's accounts. The balance on general account, as per Balance-sheet, is therefore £59 10s. 3d. against £51 11s. 4d. a year ago.

The expenses connected with the removal of Dr. Carpenter's collections, and fitting up the same in the Club-room, fitting up the dark room, lockers, apparatus, and new notice boards, have been charged to the Special Fund Account. This now stands at £4 11s. 4d.

The Treasurer would like me to add that if members would kindly pay their subscriptions as early in the year as possible, considerable correspondence, postage, &c., would be saved, and the business of the Club facilitated.

The excursions during the summer months have formed as usual an enjoyable feature of the proceedings of the Club, ladies accompanying the party on several occasions. The whole day excursions on Bank Holidays were well attended, the half-day excursions and evening rambles less so.

The first excursion of the summer season to Caterham, Godstone, Tilburstow Hill, and Oxted, took place on Whit Monday, under the leadership of Mr. Lovett, and was favoured with brilliant weather. A party of about twenty members and friends proceeded from Caterham to Gravelly Hill, on the summit of the North Downs. Here in woods and thickets on the chalky soil were found many botanical rarities, especially orchids, as the fly-orchis (*Ophrys muscifera*), the butterfly orchis (*Habenaria chlorantha*), *Gymnadenia conopsea*, *Cephalanthera grandiflora*, and *Epipactis latifolia*; also *Daphne Laureola*, *Campanula Trachelium*, and *Hippocrepis comosa*. The Roman snail, *Helix pomatia*, was abundant here, and several species of butterflies. From the summit of the hill a glorious view was obtained over the nearer ranges to Leith Hill, the Weald, and the South Downs. Passing along the crest of the hill, a nest of the tit-lark (*Anthus pratensis*) was found containing four eggs, one being that of a cuckoo, distinguished from those of the tit-lark by being somewhat larger

b 2

and lighter in colour. Descending to Godstone, a halt was made for luncheon, after which the party went on to Tilburstow Hill, where some time was spent in watching a detachment of the London Irish Volunteers signalling with the heliograph to others on Gravelly Hill, some two or three miles distant, and on Holtye Common, still further in the opposite direction; these stations forming links in a chain of heliographic communication established on that day between Chatham on the east and Aldershot on the west. A fine section of the Folkestone beds of the Lower Greensand was exposed in a sand-pit by the roadside at the top of Tilburstow Hill. After crossing Tilburstow Common, where *Rhamnus Frangula* was found, and stopping to slake their thirst at a spring of deliciously cool water issuing from the foot of the hill, the party came to Tandridge Mill. In the mill-ponds the sweet flag, *Acorus Calamus*, was found. Passing the mill, with its overshot wheel and picturesque ponds and cascade, they went on through woods and hop-fields to Tandridge Church, prettily situated among trees. In the churchyard is a noble yew tree of immense girth and great antiquity, the trunk hollow with age, but the branches still of vigorous growth. In the church itself the most noteworthy features were the massive timber framework supporting the belfry and spire, and the curious dormer windows serving the purpose of a clerestory on the south side. The route then lay by Oxted Green to Oxted, and thence home by train.

On Saturday, June 17th, a half-day excursion was made to Kew Gardens, always full of interest and beauty; though at this time suffering only too evidently from the effects of the prolonged drought. The rock garden, herbaceous borders, *Victoria regia* house, and palm house were visited.

On June 29th a heavy storm of rain, one of the very few which occurred during the past dry summer, prevented an evening botanical ramble which had been arranged to Shirley Hills and Addington Park.

On July 8th a half-day excursion was made under the auspices of the Botanical Section to Box Hill and Leatherhead, Mr. Mennell acting as guide. The parched and stunted condition of the vegetation, owing to the long drought, was unfavourable for the objects of the excursion. Arriving at Burford Bridge, the party climbed Box Hill, a precipitous spur of the chalk escarpment, at the angle where the valley of the Mole cuts through the North Downs. The hill takes its name from the box-trees which grow abundantly on the steep chalky slopes, and is perhaps the only British station in which *Buxus sempervirens* is native. The other Box Hill rarity, *Teucrium Botrys*, was not found, nor were the bee-orchis and other orchids which have been recorded from there. On the way from Box Hill by Headley Lane to Leather-

head were found a few interesting chalk plants, as the hound's-tongue (*Cynoglossum officinale*), the black mullein (*Verbascum nigrum*), and *Phyteuma orbiculare*, After tea at Leatherhead the party returned by train to West Croydon.

On Saturday, July 22nd, a half-day excursion was made under the guidance of Mr. Bayard to Wotton and Abinger. The attendance was small. Leaving Gomshall Station, the route lay along a sandy ridge, formed by the outcrop of the Folkestone beds of the lower greensand, and occupied by woods and "roughs" or furze-covered commons, to Deerleap Wood. On the way a granite cross was passed, marking the spot where Bishop Wilberforce was killed by a fall from his horse on July 19th, 1873. In the open pastures mushrooms were found, it being somewhat unusual to find them so early in the season. The champignon, *Marasmius oreades*, was also very abundant, forming large rings, one of which measured 23 ft. in diameter, and had a large furze bush growing in the centre of the circle. Numerous birds were observed. In Deerleap Wood is a barrow not very perfect, consisting of a mound about 6 ft. high, surrounded by a circular trench, the mound and trench being separated by a shelf on apparently the natural level of the ground. The extreme diameter across the barrow between the outside edges of the trench is fifty yards. Passing Wotton Hall, the home of John Evelyn, and still of his descendants, and the rock-hewn mausoleum of the family, the party proceeded down the valley of the Tillingbourne to Abinger Mill. The mill-pond and other pieces of water in the course of the stream afforded a series of picturesque views for the camera. The wild balsam, *Impatiens* fulva ~~*noli-me-tangere*~~, grew abundantly on the edge of the mill-pond and down the course of the stream, and the French willow herb, *Epilobium angustifolium*, with its vivid rose-coloured flowers, formed great masses in the woods. Other plants seen were the lady fern, *Scirpus sylvaticus*, *Verbascum nigrum*, and *Anchusa arvensis*. *

The Bank Holiday excursion on August 7th was made to Cowden and Holtye Common. In the unavoidable absence of Mr. Sturge through an accident, Mr. Murton Holmes acted as guide, and gives me the following account of the day's proceedings:—The party, numbering seventeen, arrived at Cowden about 11.30. Mr. Holmes himself, who had come by an earlier train, had in the meantime been exploring some fields near the station. Here blackberries were very fine and plentiful, and several specimens of *Erythræa centaurium* with white flowers were found, also the orpine, *Sedum Telephium*, just coming into bloom. Insects were also tolerably abundant, more especially the large heath butterfly (*Hipparchia tithonus*), which was in good condition. Two or three specimens of the dingy skipper (*Hesperia tages*) and some "small coppers" were also taken.

* see correction on p. lxiii

On leaving the station the party walked to the village, where they were shown over the church by the rector. This building was erected during the 14th century upon the site of a Saxon wooden edifice, the charred remains of which had been discovered when digging. It was enlarged by the addition of an aisle about 200 years ago. The rector stated that at one time there were no fewer than nineteen altars dedicated to different saints in the church, which was by no means a very large one. From Cowden the party proceeded along the high road to Holtye Common, finding on the way *Agaricus campestris* and *Boletus edulis*. At the inn a halt was made for refreshment, after which the party walked across the common towards the Furnace Ponds. On the common were found the sweet mountain fern, *Lastrea Oreopteris*, in profusion, also *Blechnum spicant*, and here and there on the banks, *Lastrea Filix-mas* and *L. dilatata*. The Furnace Pond takes its name from some ironworks which formerly existed here, and is said to occupy the site of excavations made for iron-stone. The railings which now surround St. Paul's Cathedral were cast at these ironworks. Close by a tunnel in the solid rock was observed. In this pond a large quantity of the narrow-leaved bulrush (*Typha angustifolia*) was growing, and a little further on, in Scarlett's Pond, the broad-leaved species (*T. latifolia*) was equally abundant. Judging from the planks that were seen it was being cut for the market. The banks of the pond were clothed with *Mentha aquatica* in full bloom, and here and there was found the forget-me-not. Several interesting timbered houses with massive chimneys, suggesting comfortable chimney corners, were passed, and photographs of these were taken. All along the route the wall-brown butterfly (*Lasiommata megæra*) was abundant; some specimens of the sulphur butterfly (*Gonepteryx rhamni*) and some blues were also captured. Among the plants collected were *Achillæa ptarmica*, on the banks of what had once been a pond, *Scabiosa succisa*, and a variety of *Campanula rotundifolia* with large flowers, shorter and more open than the ordinary harebell. The walk was a most enjoyable one. Although the weather looked somewhat doubtful early in the day, the sun came out in full force about noon. Some of the party returned from Dormans Station, others went on to Lingfield, and returned by a later train.

On August 15th an evening ramble was made to Waddon for the River Wandle. In the grounds of Waddon Lodge, through the kindness of Mr. Waterall, the pool fed by springs, which forms one of the chief sources of the stream, was seen; and in an adjoining damp meadow, the verdure of which formed a refreshing contrast to the general arid brown in this season of drought, were found several marsh plants, as *Caltha palustris* and *Carex hirta*, not abundant in the neighbourhood of Croydon.

On Aug. 19th an excursion took place to Eltham and Charlton. The first place visited was Eltham Palace, formerly a moated manor house, the foundation of which is commonly ascribed to King John, though probably few parts, if any, of the existing buildings are of so early a date. It was used habitually as a royal residence down to the time of Henry VIII., and occasionally as late as that of James I., and is still Crown property. The most noteworthy of the existing buildings is a noble hall, built by Edward IV., now dismantled, and in a somewhat dilapidated condition, but untouched by so-called restoration. It has a very fine open timber roof, with hammer-beams and pendents, and the perpendicular tracery of the windows and the vaulted roofs over the entrances are very good. The remainder of the site is occupied by several dwelling-houses, which contain portions of old work, though for the most part they are comparatively modern. The old palace was surrounded by a deep moat, now containing water only on the north and a portion of the east sides. The moat is crossed on the north side by a stone bridge, date about the latter part of the 15th century, which forms a very picturesque object. The party had the advantage of the explanations of Mr. Jones, of the Archæological Society. From Eltham the party walked to Charlton, passing near Shooter's Hill and the Herbert Hospital, and obtaining on the way a very fine view of the hills in the direction of the Crystal Palace and Croydon. Charlton House, a fine Jacobæan mansion, was also passed. The Roman camp at Charlton, which was the next object made for, stands on a hill overlooking the Thames and the marshes bordering it on the Kent and Essex shores. The ramparts, much obliterated by the hand of Time, remain only on the W. and S. sides, the hill on which the N. and E. walls of the camp stood having been quarried away by a series of extensive excavations made for the purpose of getting gravel, &c. An excavation on the N.W. side of the hill on which the camp stands shows the Thanet sands resting on the chalk. The junction of the two formations is marked by a bed called "bull-head," consisting of green-coated unworn flints, and ranging in thickness from 6 to 18 in., being thicker where it fills up inequalities in the surface of the adjacent chalk. (The same bed is to be met with in the chalk-pit at Park Hill, Croydon). The lowermost 7 ft. of the Thanet sand are locally called "black-foot" or "strong loam," and are valuable for foundry purposes, being well adapted for moulds for brass castings. The 12 ft. next above the "black-foot" consist of "mild loam," larger grained and less cohesive than that below, and better adapted for moulds for iron castings. These loams are indeed exported for foundry use to parts of the world so distant as India and China. The upper part of the Thanet sand is a white sand. On the steep face on the E. side

of the Camp hill this white sand is the lowest bed now exposed. Above it is a greenish sand, with rounded black flint pebbles, the lowermost of the Woolwich beds; above this again is a bed of strong reddish loam, also used for foundry purposes. Next above this come some 8 ft. of laminated grey clay, crowded with fossils, mostly fragmentary. Though individuals are abundant, the species represented are comparatively few. The following only were found:—*Ostrea tenera* and *bellovacina*, *Cyrena cuneiformis* and *cordata*, *Melania inquinata*, and a *Cerithium*. Above the shell-bed is a clay with few fossils, and above this again are the pebble-beds of the Oldhaven series, here some 14 ft. thick. Some fossils from the chalk were obtained from the workmen, among them being fish remains, *Inoceramus* sp., *Terebratula semiglobosa*, *Ananchytes ovatus*, *Micraster cor-anguinum*, and a spine of *Cidaris*. The party were indebted to Mr. Gilbert, of Charlton, by whom the pits are worked, for much valuable information, as well as for permission to visit them. Photographs were obtained by several members, but in other branches little was done. Of plants, *Parietaria*, *Sedum acre*, and *Corydalis lutea* were seen growing on old walls at Eltham, and *Agaricus conchatus* on a stump on the way thence to Charlton. About the pits at Charlton were found *Diplotaxis tenuifolia*, *Ononis arvensis*, and *Hieracium boreale*. These all occurred in Kent.

On September 16th a fungus hunt at Addington had been announced, but few members turned up, and, owing to the extreme dryness of the ground and air, scarcely any fungi were met with, only two woody perennial species growing on trees, *Polyporus betulinus* and *P. annosus* being found. A live specimen of the mole, *Talpa europæa*, was taken, and was found swarming with parasites, which at a subsequent meeting were exhibited by Mr. Murton Holmes mounted as microscopic objects.

Besides the ordinary excursions of the Club, on June 28th, by the kind permission of the Astronomer Royal, a limited number of members visited the Royal Observatory at Greenwich. Greenwich Observatory, being pre-eminently a place for scientific work rather than for show, is not open to the general public like Kew Gardens, and the members of the Club were indebted to the good offices of Mr. Bayard for the opportunity of seeing it. The Observatory, which was founded by Charles II. in 1675, stands on a limited area of ground on the summit of a steep mound of Thanet sand, 155 ft. high, in Greenwich Park, commanding a fine view over the Thames; its administration is under the Admiralty, and there is a nautical air about it, especially in the way in which the utmost use is made of limited space. The work carried on at Greenwich is twofold, astronomical and meteorological, and the party on arriving at the Observatory was

divided into two detachments, which in alternate order were taken round first one and then the other department by members of the respective staffs, to whose kindness and clear explanations we were much indebted.

On the astronomical side, the first object seen was the transit instrument. This is a large telescope mounted between two massive masonry pillars in such a way as to swing in a north and south plane or meridian. The field of the telescope is crossed by five equidistant vertical "wires" (really made of fine spider's threads), and one horizontal one. The exact observation of the position of a star requires the determination of the time at which it crosses the meridian, and of its then distance from the zenith. The time determination is made by the observer pressing a knob each time that the star, as seen in the telescope, crosses successively one of the five vertical wires; this closes an electric circuit, and makes a dot on a graduated paper fixed on a revolving drum in another apartment; the mean of the five records gives a very accurate determination of the time when the star crossed the meridian. The zenith distance or declination is measured on an accurately divided platinum circle attached to the transit instrument; this is observed through fixed microscopes furnished with a comb-shaped micrometer arrangement, by which the circle can be read to the fraction of a second of arc. In the same room are preserved various astronomical instruments of historical interest. Through a telescope in another room the members obtained a view of the sun, on which a large sun-spot was visible at the time. They also saw the dome in which the large new refractor, with object-glass twenty-eight inches in diameter, is to be mounted.

In the meteorological department the most remarkable feature is the series of self-recording instruments by which, through the aid of photography, a continuous record of meteorological and magnetic elements is obtained. In instruments in which the amount of movement to be measured is very small, the movement is made to alter the position of a small mirror, upon which a beam of light falls, and is reflected to a sheet of sensitive paper on a revolving drum; the amount of movement as shown by the spot of light being multiplied manifold by the angular displacement of the mirror. The self-recording instruments and barometer are placed in a cellar to avoid changes of temperature and accidental vibrations. Before entering this, the party had to leave behind their keys, knives, and other iron articles. Besides the ordinary meteorological instruments, sunshine-recorder, anemometers, &c., there are the earth thermometers, mentioned in my paper on "Earth Temperatures" (Trans., Art. 110), the deepest of which has its bulb at a depth of 25 ft. below the surface. These do not require to be pulled up to take the readings, but

are made with stems long enough to reach above the level of the ground, the scales being enclosed in a wooden case. There is also an apparatus for determining the amount and sign of atmospheric static electricity: this consists of a jet of water acting as collector, which is supplied from an insulated cistern connected by a wire with a quadrant electrometer with photographic recording arrangement. Earth currents of electricity are measured by galvanometers in circuit with insulated lines of wire connected at either end to copper plates buried in the earth. There are two such lines of wire, each several miles in length; the direction of one being approximately north-east and south-west, of the other south-east and north-west. During the past two or three years the character of the earth current records has undergone a curious alteration. Instead of the normal diurnal oscillations of small extent previously observed, there are movements of much greater amplitude at frequent intervals during eighteen hours of the day, beginning about 6 a.m., and ceasing about midnight; the currents during the remaining hours of the twenty-four retaining their previous character. On Sundays the stronger currents do not begin until midday. On comparison of the times, it is found that these abnormal currents correspond with the passage of trains on the electric railway from London Bridge to Brixton, which does not run within four miles of the Observatory. A small deflection occurring regularly at every hour is found to be caused by the electric time signal given at the Observatory. The effects of these artificial currents are however far surpassed by the strong earth currents which occur from time to time during magnetic storms.

On April 15th, through the kindness of Mr. Collyer and Mr. Graburn, a party of members of the Club had the opportunity of opening a barrow at Wepham Down, Burpham, on the Sussex downs, near Arundel. The results of the exploration were given to the Club by Messrs. Lovett and Collyer at the meeting on May 10th (Trans., Art. 112).

At the evening meetings of the Club a fair number of papers have been read. For three of these we have been indebted to friends outside, the others have been contributed by members of the Club. The attendance of members from various causes has not always been so good as might be wished. The Committee would be glad to see a larger number of members, especially the younger ones, contributing to the proceedings of the Club,—not necessarily long or elaborate papers, but, it might be, short notes on matters coming within their observation which might serve as a text for discussion. The exhibition of objects, with explanatory remarks, adds interest to our evening meetings, and we should be glad if more members would assist in this way.

On Feb. 8th, the Report of the Meteorological Sub-Committee for 1892 was presented by Mr. F. C. Bayard, honorary secretary of that Sub-Committee. This Report was published in our volume of 'Transactions' in 1893 (Trans., Art. 109, p. 28). A paper was also read by your President on 'Earth Temperatures,' in which he gave the result of a series of observations made at Croydon in 1892 at depths of one foot and four feet below the surface, and also gave a *resumé* of the subject of ground temperatures, pointing out how, owing to the badly conducting properties of the earth, the diurnal and annual heat waves were retarded at progressive depths, and their range diminished; while at depths beyond that to which the annual heat wave extends the temperature was found to increase with the depth. This paper will be printed in our annual volume for 1893 (Trans., Art. 110).

On March 8th a paper was read by Mr. Charters White entitled "A simple Method of Photo-micrography," in which he dealt fully with the processes and apparatus which he advocated; after which a large number of photo-micrographic slides were thrown on the lantern and explained by Mr. White; their beauty and sharpness of detail being much admired.

On April 12th, Mr. Lovett exhibited and described a series of mechanical fire-making appliances, in which a flint and steel arrangement was put in action by means of a trigger. The Hon. Secretary exhibited and described a specimen of the now rare Solar microscope of the last century. A very interesting paper was read by Mr. A. B. Farn on "Pasteur's Researches on the Cause and Prevention of the Silkworm Disease," some of the results of which Mr. Farn had himself experimentally verified. Glancing at the culture of the silkworm as an industry, he traced the appearance and spread of the disease which were attributed to overcrowding of the young worms on the part of the cultivator; showing how Pasteur had demonstrated that the disease, which is known as *Pébrine*, was caused by the invasion of the tissues of the silkworm by a parasitic bacterium, and that it might be communicated by inoculation, by feeding on leaves soiled by the excrement of infected worms, or by infected dust carried in the clothes of the attendants; and also that it was hereditary, the parasite being found in the ova deposited by infected moths. The special seat of the parasite is in the silk glands, the ducts of which become so blocked as to prevent the spinning of silk. This paper will be printed in our 'Transactions' (Trans., Art. 111).

On May 10th, Mr. Lovett read a Report on the opening of a Barrow on the South Downs, near Arundel, recently carried out by members of the Club. Having briefly referred to various

ancient forms of burial, he gave a detailed account (which will be published in our 'Transactions,' Art. 112) of the measurements, structure, and contents, comprising bronze, glass pottery, ironstone, flint, &c., of this barrow, which he considered to date from the early iron period. He also described another place of interment in the neighbourhood of this barrow which was opened on the same occasion, and in which were found three skeletons, and fragments of Samian pottery. The skeletons were evidently those of persons of considerable stature, and of one the thigh-bone had been fractured and reunited at a period long before death. The remains were considered to be of the Anglo-Saxon period. Mr. Collyer made some supplementary remarks on the same subject, and exhibited the bones and other objects obtained in the excavations.

The meeting on September 19th was devoted to exhibition of specimens, and short communications thereon. Mr. Murton Holmes exhibited specimens of the freshwater polyzoon, *Alcyonella fungosa*, from the Brent reservoir, Middlesex, and described its structure and propagation; also parasites from the mole. Mr. Goodman exhibited nests of the common and tree wasps, so plentiful during the hot dry summer of 1893, and gave an account of the life-history of the wasp, and of the mode of formation of the nest. He attributed their recent abundance to the dry weather of March being favourable to the founding of colonies by the queens who survived the winter. He also exhibited a photograph of an ancient fresco painting in Warlingham Church. Mr. Lovett exhibited a series of stands for simple microscopes designed by working-men "out of their own heads." He also made some remarks on the evolution of artistic designs from simple natural objects, showing in illustration a series of snuff-bottles from South Africa; the most primitive of these being a simple gourd, of which the shape was afterwards copied in other materials as wood, gut, ivory and pottery. Another illustration was afforded by a series of cigarette-holders from Holland, originally made of the leg-bone of a hare, but the shape of which was subsequently copied in meerschaum.

On October 17th, Mr. Goodman read a communication from Mr. Budgen on "The Life-history of the Water Insect, *Gerris najas*," illustrated by photographs (Trans., Art. 113). The President read a paper containing some notes of a recent visit to Belgium, exhibiting in illustration photographs, fossils and dried plants (Trans., Art. 114).

The Twenty-fourth Annual Soirée took place at the Public Hall on November 22nd, and was well attended, though the number of persons present, 567, was slightly below that of last

year. The sale of tickets realised £20 9*s.* The societies represented were as follows:—

	Exhibitors.	Microscopes.
Croydon	30	17
Royal	3	5
Quekett	12	13
South London	5	6
Holmesdale, Redhill and Reigate	5	6
Various and Unattached	26	22
	—	—
	81	69

The number of microscopes was less than on previous occasions, but the falling-off was mostly in familiar objects, many of the slides exhibited being of a very interesting character. Among these may be mentioned: wax insect (W. West); living rotifer, *Rhinops vitrea* (C. Rosselet); tail of goldfish showing circulation of blood (T. D. Ersser); eyes of living spider (J. A. Smith); section of pearl (W. Smart). A very fine series of photographs was exhibited by the Photographic Section in lantern, and as transparencies, as well as on the walls of the corridor. Among the other exhibits were a large collection of British Lepidoptera, by Mr. Crowley; zoological specimens, by Mr. Drage and Mr. Thorpe; a collection of fish-hooks, illustrating their development from prehistoric times, and a miniature rock garden with living plants, by Mr. Lovett; Roman coins found at South Croydon, and Anglo-Saxon weapons and ornaments found on the Elms Estate, by Mr. Rigby; relics of Roman and mediæval London, by Mr. Straker; Japanese articles of daily use, by Mr. Alfred Parsons; steel mill formerly used for giving light in collieries, by Mr. E. Bidwell; photographs of pathological Bacteria, by Dr. Klein, F.R.S.; a fine series of rare plants, chiefly from Surrey, Berks and Argyllshire, by Mr. C. E. Salmon, &c. The collection of flowers gathered in the open air at Addiscombe comprised 73 kinds, as against 113 the previous year; while that of fungi from the neighbourhood of Croydon numbered 28 species, against 38 in 1892; the diminution in each case being due to the cold ungenial weather which had prevailed for some weeks before the Soirée.

On December 19th a lecture was given by Mr. H. B. M. Buchanan, B.A., on "Evolution."

The lecturer said that evolution, that is the development of all forms of organic life from previous forms, was now generally accepted by scientific men, at any rate as a working hypothesis, which was more likely to be true than untrue. The analogy of

the series of living forms, however, was not with a continuous chain, but rather with a tree, the branches from the trunk not all tending upwards, but some sideways, and some even downwards, so as to fill every space in nature with some appropriate inhabitant. He considered the theory of evolution under the following aspects:—1. The history of the idea in the human mind. 2. The evidence for evolution afforded by morphology. 3. The evidence afforded by embryology. 4. The evidence afforded by palæontology.

1.—The idea of evolution seems to have been first mooted by the Greek philosopher Anaximander (B.C. 611), who held that all land animals had been primarily marine. Owing, however, to the omission to verify their ideas by an appeal to observation and experiment, Greek speculators often went very far wrong. Bruno, in mediæval times, also mooted similar ideas, but the general tendency of the thought of the age was hostile, and no advance was made until the present century. Lamarck (1809) held that the slowly changing external conditions under which living forms were placed would necessitate use and disuse of particular organs, and that this use or disuse produced changes of structure, which were handed down to the descendants. Agassiz pointed out that in descending from the higher to the lower forms of life the structure became simpler and simpler, and that a similar progress was met with as we went back in the history of development of the individual, and in geological history. The successive introduction of higher forms of life did not however entirely supplant the lower forms, but compelled them to take a subordinate place. This author, however, held that new forms of life appeared as the result of special creation, and not by development from pre-existing forms. Darwin, on the other hand, believed that the numerous different forms of life arose from one or a few original forms. He pointed out that the principle which Malthus had enunciated for the human species, *viz.*, that the multiplication of individuals tended to take place at a greater rate than the means of subsistence for them, applied to all living beings; hence there was a perpetual struggle for existence, in which those varieties which adapted themselves to changing conditions survived, while others did not. Weismann, while accepting the theory of descent, denies the transmission of acquired characters. He holds that the "body cells," which minister to the nutrition of the individual, are fundamentally distinct from the "germ cells," which perpetuate the race; and that acquired characters affect only the body cells, and not the germ cells; while the latter alone transmit characters. It has yet however to be proved that the body cells do not act on the germ cells, and the controversy is still progressing.

2.—Evidence in favour of evolution is afforded by morphology

by the unity of type which runs through allied forms however different in external form; thus the whale and the giraffe possess the same number of cervical vertebræ in spite of the different length of their necks; also by the existence of rudimentary organs, derived from ancestors in whom they were of functional importance. Examples are the rudimentary concealed hind limbs of the whale and the python, the teeth of fœtal whales, and the eyes of blind fish. Examples of such organs in man are the fold of skin at the inner angle of the eye, which represents the membrana nictitans or third eyelid of lower animals; the muscles of the external ear and scalp, which in only a few persons are under voluntary control; the coccyx, or bony rudiment of the tail, more prominent in the fœtus; and the appendix vermiformis cœci, which in the lower mammalia performs the function of a supplementary digestion. The hair on the human body sloped downward as in the anthropoid apes, doubtless in order to throw off the rain; and in the human fœtus hair was more general over the surface of the body. New-born infants possessed a remarkable prehensile power in the arms, and the soles of their feet faced inwards, the great toe projecting at an angle from the others, presenting an approach to the hinder limbs of apes.

3.—Embryological study showed that the history of development of the individual recapitulated that of the species. Thus the tadpole of a frog passed from the egg through forms resembling a fish, and a tailed water breathing amphibian to the tailless air breathing adult frog. The germ cells are similar in all classes of animals, but their development proceeds to different lengths in different species. The progress is from the more general to the more special; different forms in their development proceeding for a greater or less distance along a common path, and then branching off.

4.—Palæontology also shows a gradually ascending scale of life in the fossils preserved in the rocks, though the geological record is very imperfect, and there are many missing links, which, however, are gradually being supplied.

The meetings of May 10th and December 19th were open ones, ladies as well as gentlemen being invited to attend.

The monthly conversational meetings have not been well attended. During the past year the day on which the ordinary meetings of the Club are held has been altered from the second Wednesday to the third Tuesday in each month. It having been represented to the Committee that many members were prevented from attending the meetings of the Club, by their clashing with the meetings of several learned societies and other engagements

on the same evening, a circular was sent to each member of the Club inviting his opinion as to the advisability of changing the day of the week for the ordinary meetings from Wednesday to Tuesday. The replies received having shown a large preponderance of opinion in favour of the change (75 replies being in favour, 29 against, and 32 neutral), a proposal to that effect was, after due notice, brought forward at the meeting on May 10th (which was rendered special for the purpose), and was carried unanimously, the change taking effect from September. It is at present perhaps too early to say how far the hope of an increased attendance as the result of the change has been realised, but we find that unfortunately it is impossible in such a matter to suit the convenience of all parties. The conversational meetings will continue to be held on Wednesdays, so that those members who cannot attend on Tuesdays may still keep in touch with the Club; but it is proposed that they shall always be held on the last Wednesday in each month, as otherwise they would occasionally fall on the evening following the ordinary meeting.

The Sub-Committees for Botany, Geology, Meteorology, Microscopy, Photography and Zoology were reappointed as usual, and have continued their work with varying degrees of activity. I would call the attention of members of the Club to the existence of these Sub-Committees, who are at all times glad to receive notice of any facts of interest connected with the natural history of the district, and to assist beginners in their several departments. The names of the members of these Sub-Committees will be found on the back of the annual card.

The Honorary Secretary of the Photographic Sub-Committee gives me the following satisfactory report of that section:—

The Photographic Section of the Club, I am happy to say, has again passed through a very successful season. Numerous excursions were arranged and carried out during the summer, but were not quite so well attended as might have been wished, and I should recommend that an Excursion Committee be formed to carry out arrangements both as regards localities and places of interest, and for the proper recording of objects that would be of value to the Club generally.

Technical and conversational meetings, monthly lantern nights, and trial nights, have been held as usual. The dark room is being continually used, and forms a most useful room for practical demonstrations.

At the Soirée this year, the pictures showed a high standard of excellence. A large selection of framed exhibits,—showing a preference for framed work rather than the usual mounts only pinned on the frames. The number of processes employed for their production being albumenized paper, bromide carbon, platinotype, gelatino-chloride, and mezzotype. A large table in the Small Hall was devoted to transparencies, of which there was a large number; the School of Art Room being devoted to lantern exhibitions during the evening.

The membership of the section numbers about 70, and is slightly on the increase; it would have been better but for several resignations. The Committee hope that any members wishing to receive the benefits of the section, or contemplating practising photography, will send their names in to the Hon. Sec. of the section, from whom particulars as to use of dark room and lockers may be obtained.—HARRY D. GOWER, *Hon. Sec.*

From Mr. Mennell I learn that

The Botanical Sub-Committee have nothing of interest to report; little or nothing has been done in connexion with the Club Herbarium, and help from younger members in its arrangement, preservation, and increase would be gratefully welcomed. In the 'Journal of Botany,' the Rev. E. S. Marshall records the occurrence of *Fumaria parviflora* near Witley as an addition to the county flora.

Mr. F. Barlow brought me specimens last September of one of the balsams, *Impatiens parviflora*, from near Titsey; this plant is nowhere a native, but occurs in various localities as an alien—or introduced plant. *Senecio viscosus*, which I noticed some three years ago as a novelty in this section of the county, holds its own on Park Hill, and was fairly abundant this summer.

A conversational meeting was held under the direction of the Botanical Sub-Committee on January 24th, at which I endeavoured to explain and illustrate the best methods of selecting specimens of plants for the Herbarium, so as to exemplify their more important characters, as well as the best methods of drying, preserving and mounting them.

The Honorary Secretary of the Meteorological Section reports as follows:—

The Meteorological Sub-Committee has continued its work under the supervision of its Honorary Secretary, Mr. Bayard. The daily rainfall of 52 stations in the Club district has been tabulated every month, examined and corrected, and the results printed and issued to the observers and all members of the Club interested in the question, either before, or within a very few days after, the end of the month succeeding that to which the statistics refer. Further particulars will be found in the scientific report of the Sub-Committee, which will be presented at the meeting next month. The expenses of the section have amounted to £25 2s. 7d., towards which four gentlemen interested in the work of the section contributed £20, the Club paying the balance.—F. C. BAYARD, *Hon. Sec.*

From the Geological Sub-Committee I have not received any report.

The Zoological Sub-Committee report that nothing has occurred during the past season to call for special notice. Mr. Berney gives me a list of families and species of moths taken in his garden at Croydon in the evenings of the summer of 1893, after 6 p.m.; it comprises 66 species belonging to 17 families, as follows:—Sphingidæ 1; Sesidæ 1; Hepialidæ 2; Oncoptery-

gidæ 2; Ennomidæ 2; Acidalidæ 2; Caberidæ 1; Larentidæ 5; Leucanidæ 1; Apamidæ 12; Caradrinidæ 1; Noctuidæ 15; Orthasidæ 10; Cormidæ 2; Hadenidæ 4; Plusidæ 2; Amphipyridæ 3.

A conversational meeting was held on Feb. 22nd under the auspices of the Zoological Section. The subject discussed was the causes of the abundance in particular seasons of certain insects usually uncommon, with special reference to *Colias edusa*, so plentiful in 1892. The prevalent opinion in reference to this particular insect seemed to be that in the British islands it does not survive the winter, and that the specimens observed in this country in summer are a second brood, the progeny of specimens of the first brood, which have been blown over from the Continent early in the year.

Mr. Murton Holmes, Honorary Secretary of the Microscopic Sub-Committee, gives me the following report:—

A hope was expressed last year that some demonstrations upon the practical work of the microscope could be arranged, and the Sub-Committee is pleased to be able to report that by the kind assistance of several members some successful demonstrations were carried out. The first was undertaken by Mr. Aldous, who gave a graphic account of the construction of the microscope, explaining the theory both of the simple and compound forms. The next demonstration was by Dr. Franklin Parsons on the various methods of microscopic illumination [which was especially valuable, as a proper method of using mirrors and condensers is essential to obtain good definition.] Mr. Lovett devoted an evening to the preparation and mounting of objects in liquid, showing how cells should be made to retain the liquid in which the objects are preserved, and what precautions are necessary to mount the objects without distortion. Mr. Holmes explained how objects could be rapidly mounted in Canada balsam, and the manner in which they should be attached to glass slips when sections by grinding were required. On a subsequent occasion he also illustrated the washing and preparation of some diatomaceous earth for mounting.

The Sub-Committee earnestly hopes that members will more frequently bring objects of microscopic interest for exhibition at the ordinary evening meetings, and hopes to be able to make arrangements to facilitate this.

I may here mention that Mr. Aldous kindly undertakes to have a microscope stand ready at all ordinary meetings of the Club, so that members wishing to exhibit slides need not bring a microscope, but only the necessary objectives, having the universal screw. I may also call attention to the valuable collection of slides in the Club's cabinet, selections from which members are allowed to take home and examine at their leisure.

I may too in this place refer to the Club's library, and point out that books may be taken out at any meeting of the Club on

application to the Librarian, and retained for a reasonable time. It is probable that many members are not aware of these privileges, and that this is the reason why more use is not made of the library and micro cabinet. It is to be hoped that the Club may one day possess a microscope of its own with all necessary apparatus complete.

The collection of shells, corals, fossils and minerals, generously presented to the Club by the family of the late Dr. Alfred Carpenter, has been mounted in cases during the year under the superintendence of Mr. Lovett.

Glancing now at the future of the Club, I do not see why it should not have a long lease of prosperity before it. We were told by our last lecturer that those animals survive in the struggle for existence which can adapt themselves to changing conditions, and we endeavour to do so. It must be admitted that the conditions affecting the life of a club such as ours have somewhat changed since its establishment, now nearly a quarter of a century ago. Natural science is now taught in other ways, as by technical classes and university extension courses, so that persons whose bent lies in that direction are not necessarily attracted to the Club. The microscope, with which the Club was at first especially concerned, though more indispensable than ever as an instrument of research, has somewhat gone out of fashion as the amusement of the amateur, having been supplanted by the photographic camera. In a district so well known as Surrey, it is not likely that many additions to the fauna and flora remain to be made by the field naturalist, save in certain critical groups, and in the minuter and less studied invertebrate and cryptogamic orders. These comparatively neglected orders however well deserve attention; the microscope reveals to us a world of beauty and interest in the lower forms of animal and vegetable life, and the work of Darwin bears witness to the importance in the economy of nature of so humble and apparently uninteresting an animal as the earthworm. There is much yet to be learned about the life-history of even familiar animals and plants, especially by watching them through the various stages of their existence. A wide field for observation also remains open in tracing the various modes in which living beings are able to secure for themselves a place in the competition for existence by obtaining food, by protecting themselves against the attacks of their enemies, and by promoting fertilization, and making provision for the welfare of the young. Even the artificial state of things, as we call it, caused by the growth of human population merely introduces a new set of conditions into the struggle for existence, to which some species are able to adapt themselves, while others are not. Thus while some wild birds seek safety in

avoiding man by their powers of flight, others, as the sparrow and robin, place themselves under his somewhat treacherous protection, doubtless finding the safety which they obtain from their feral enemies to more than counterbalance the attacks of cats and birdnesting boys. The fieldfare and redwing nest in northern climes, and when visiting us in the winter feed in open fields, with sentries on the alert to give warning against the approach of an enemy; while their congener, the blackbird, frequents the neighbourhood of human habitations, and skulking about gardens and hedge-bottoms manages to pick up a good living even in the severest weather. A curious change of habit in this respect has recently come over the wood-pigeon, which in its wild state one of the wariest of birds, has become very abundant in the London parks, where, knowing apparently that guns are not permitted, it shows no more fear of man than a London sparrow. Some such change of habit in a past age has enabled the rook and jackdaw to flourish, while the raven and carrion crow are approaching extinction.

We must all regret the disappearance of some of the more interesting plants and animals from our neighbourhood. The diminution of wild birds has been recently the subject of discussion in the local press; the primrose has disappeared from woods near Croydon where it was formerly abundant, and we must go many miles afield to find any fern other than the common brake in plenty. I do not think that the disappearance is due to the naturalist, or even to the ordinary holiday maker, so much as to the professional dealer, who collects wholesale for purposes of gain. The primrose is unfortunately circumstanced in the struggle for existence; its beauty makes it in demand; it is easily found and dug up at any time of the year (not like the bluebell and daffodil, which have deep underground bulbs), and its dimorphic habit is unfavourable to the production of seed when its numbers are reduced, since it can only be fertilised when both forms of flower grow together. Whatever British institutions the late Lord Beaconsfield may have helped to preserve, I fear that he did not do much for the poor primrose.

The draining of marshes and ponds, the ploughing up of pasture, and the conversion of open fields into eligible building sites, are processes which cause the disappearance of many of our more interesting species of animals and plants. These we cannot hope to arrest, but we can avoid rapacious collecting, or encouraging dealers by purchasing from them. There is no reason why plants like the primrose and ferns should not be propagated by seed, or parting the roots, instead of uprooting them from their native habitats.

In geology the main features of our neighbourhood are well known, but there are doubtless many details yet to be filled in,

and I may point out the useful function which a Club like ours may serve in preserving records of geological sections, especially such as are of a temporary character. It often happens that the beds to which most geological interest attaches are not those which are most valuable in a commercial point of view—thus an abundance of fossil shells in a clay unfits it for brickmaking—and hence they are not to be found exposed in permanent openings, as pits and quarries, but only in casual diggings, as for sewers and drains, foundations of houses, new roads, and wells. Well sections are especially important to be recorded since in a district like this we depend upon them almost entirely for a knowledge of the deep geology.

I may mention that the objection which I have raised to purchasing wild animals and plants does not apply to fossils, which do not propagate themselves; on the contrary, the knowledge that such things have a value in money or beer leads workmen to preserve specimens that would otherwise be thrown away.

I regret that I cannot say much upon photography, never having acquired that pleasing art. I will only point out the valuable service which the Photographic Section might render to other sections of the Club by preserving records of natural features of interest, such as of remarkable trees, of plants of which the characters are imperfectly preserved in a dry state, of geological sections, ancient buildings, &c. A Club album might be formed for the preservation of these records.

Anthropology and archæology find a place,—indeed, a considerable one,—at our meetings and excursions, but have not been recognized as yet by the appointment of a sub-committee. It is possible that such a sub-committee might do good service in preserving records of the fast disappearing relics of past times in our town and neighbourhood. Probably, however, those members most competent to act on such a committee are already on other sub-committees.

Sub-Committees.

The members of the following Sub-Committees will, at all times, be glad to receive notice of, and to investigate, any facts of interest connected with the Natural History of the district, and to give to members of the Club any advice and assistance in their power.

Botanical Sub-Committee.—James Epps, F.L.S., Norfolk House, Beulah Hill, Upper Norwood; W. Ingrams, Whitgift Schools, Church Road; H. T. Mennell, F.L.S. (Hon. Sec.), Park Hill Rise; H. Franklin Parsons, M.D., F.G.S., Park Hill Rise; Ernest Straker, Spencer Road.

Geological Sub-Committee. — James Chisholm, Addiscombe Lodge; George Hinde, Ph.D., F.G.S., Avondale Road; E. Lovett (Hon. Sec.), Outram Road; W. Topley, F.R.S., F.G.S., Elgin Road; H. Turner, Lansdowne Road; Thos. Walker, C.E., Warrington Road.

Meteorological Sub-Committee.—F. C. Bayard, LL.M. (Hon. Sec.), Wallington; Thos. Cushing, F.R.A.S., Chepstow Road; Baldwin Latham, C.E., Duppas House, Croydon.

Microscopical Sub-Committee.—T. D. Aldous, F.R.M.S., 37, St. Peter's Road; H. Greenway, Ashburton Road; J. W. Helps, Stafford Road; W. Murton Holmes (Hon. Sec.), Glenside, St. Peter's Road; E. B. Sturge, The Waldrons.

Photographic Sub-Committee. — J. Weir Brown, Heathfield Road; A. H. Carter, Reedham, Purley; H. D. Gower (Hon. Sec.), 16, Wandle Road; W. Low Sarjeant, 7, Belgrave Road, S. Norwood.

Zoological Sub-Committee. — John Berney, F.R.M.S. (Hon. Sec.), Chatsworth Road; Philip Crowley, F.Z.S., F.L.S., Waddon; C. H. Goodman, Bryn Cottage, Whyteleaf, Surrey; H. Lee, St. John's Grove; R. McLachlan, F.R.S., F.L.S., 23, Clarendon Road, Lewisham.

The President, Vice-Presidents, and Hon. Secretary of the Club for the time being are *ex-officio* members of every Sub-Committee.

Members elected, 1893.

January 11*th.*—Henry Joseph Cooper, M.B., Cromer Lodge, Birdhurst Road. George Crabb, Redbrick Cottage, Upper Addiscombe Road. Arthur Leaver, Walbrook Lodge, Barham Road. John Yates, 15, Canterbury Road.

February 8*th.*—George Binyon, Allandale, Coombe Road. Brandon Dansie, 15, Outram Road.

April 12*th.*—Thomas Peacock, Tremonia, Chichester Road. A. R. T. Bruce, Merstham, Surrey.

May 10*th.*—Harry Lane, 7, Belgrave Road, S. Norwood. James Pascall, Ambleside, Duppas Hill. J. W. Thatcher, Eversleigh, Purley, Surrey.

September 19*th.*—Arthur P. Hoole, The Willows, Sutton, Surrey.

October 17*th.*—T. Archibald Dukes, B.Sc.M.B., 16, Wellesley Road.

Exhibits, 1893.

January 11*th.*—W. Murton Holmes, A medal of aluminium struck in memory of the Chemist Shields; also a preserved water tortoise.

February 8*th.*—Mr. Lovett, Shell ornaments from Borneo; also a Maori food dish. C. F. Bing, Geological specimens. The President, Water containing *Infusoria*, &c., and also diagrams in illustration of his paper.

March 8*th.*—C. F. Bing, Historic implements of warfare, Mr.

Aldous, Views of old London Bridge; Indian betel-nut cutters, and an Egyptian pen case.

April 12th.—E. Lovett, Fire-making appliances of the 17th and 18th Centuries, and sundry cocoons and tick. Mr. Waterall, Specimens of minerals from Switzerland. Mr. Aldous, Solar microscope. Mr. Crowley, pupæ.

May 10th.—E. B. Sturge, Parasitic fungus on mint, *Œcidium menthæ*. C. H. Goodman, Eggs and specimen of *Gerris*. T. D. Aldous, New reflector for drawing and monochromatic illumination. The President, Fresh specimens of rare British plants, seakale, *Crambe maritima, Lithospermum purpureo-ceruleum*, from Sidmouth; *Potentilla rupestris*, Breidden, *P. alpestris*, Switzerland, *Polygonatum verticillatum*, Norway, *P. officinale*, Savoy, *Helianthemum polifolium*, Torquay, *Actæa spicata*, Towton (Yorks), *Allium carinatum*, Guernsey, *Cypripedium calceolus*, Bavaria: grown in Croydon.

September 19th.—W. M. Holmes, *Alcyonella fungosa*, and a stuffed mole. C. H. Goodman, Wasps' nests, and a photograph of fresco. E. Lovett, Microscopes and articles illustrating his communication on primitive art. The President, Fungi, *Polyporus annosus*, *P. betulinus*.

October 17th.—T. D. Aldous, *Filaria sanguines-hominis*. E. Lovett, Stone implements in illustration of Dr. Parsons' paper; Pebbles covered with eggs of the stone mite, *Petrobia lapidum*, from Addiscombe. C. H. Goodman, Photographs illustrating Mr. Budgen's paper on *Gerris najas*. The President, *Fistulina hepatica*, and photographs, fossils, and pressed plants in illustration of his paper.

Library.

The additions to the Library during the year 1893 are as follows :—

From Individuals.—R. H. Worth (Author): The Erme, Yealm, and Tavy, and the moorland Plym; H. D. Gower: Photographic papers as issued.

From Societies.—Royal Microscopical Society: Journal, 4 parts. La Société Belge de Microscopie: 1892—1893, 2 parts. Eastbourne Natural History Society: Transactions, 1891—92. Essex Naturalist, 3 parts. Northamptonshire Natural History Society: 5 parts, 1892—1893. Manchester Geographical Society: Journal, 1892—1893. Berwickshire Naturalists' Club: Journal, 1891—1892. South Eastern Naturalist, Vol. I., part 3. Reading Literary and Scientific Society: Report, 1893. West Kent Natural History and Microscopical Society: Report 1892—1893. Brighton and Sussex Natural History Society: Report, 1893. Scottish Microscopical Society: Proceedings, 1891—1893.

From Proprietors.—Science Gossip.

Croydon Microscopical and Natural History Club.—Balance-sheet for the Year ending 31st December, 1893.

Receipts.

	£	s.	d.	£	s.	d.
Balance at Bank, January 1st ...	48	15	10			
Petty Cash in hand	2	15	6			
				51	11	4
Subscriptions, 1892	1	0	0			
,, 1893	116	0	0			
,, 1894	4	0	0			
				121	0	0
Sale of Transactions...				0	4	0
,, Mr. J. H. Drage's Paper ...				0	1	6
,, Soirée Tickets				20	9	0
Donations, F. C. Bayard, Esq. ...	5	0	0			
,, Philip Crowley, Esq. ...	5	0	0			
,, J. Compton Rickett, Esq.	5	0	0			
				15	0	0
				£208	5	10

Expenditure.

	£	s.	d.	£	s.	d.
Rent of Club Room				10	0	0
Hire of Rooms for Meetings ...				4	0	0
Printing Transactions, 1892 ...				20	4	2
Insurance				1	15	1
Printing and Stationery				12	12	3
Postages				12	8	8
Meteorol. Sub-Committee Printing Rainfall Returns for the months December, 1892, to November, 1893, inclusive, and sundry Postages				25	2	8
Photographic Sub-Committee; Hire of Rooms for Lantern Exhibitions	3	10	0			
Rent of Dark Room	9	0	0			
Sundry Printing, Postages and Gas	4	19	2			
				17	9	2
Gratuities				1	6	0
Soirée Expenses (subject to a further payment of £10 18s. 6d. for Tables)				38	0	7
Sundries				0	17	0
Assistant Secretary				5	0	0
Balance at Bank				59	10	3
				£208	5	10

SPECIAL FUND ACCOUNT, 1893.

£210 11s. 8d. CONSOLS.

	£ s. d.	£ s. d.		£ s. d.	£ s. d.
Balance from last Account, Jan. 1st		24 13 9	Paid for Fitting up Dark Room ...		11 7 7
Dividends—January	1 8 3		,, Removal of Dr. Carpenter's Collection	4 13 5	
,, April	1 8 3		,, Cleaning and Fitting ditto	3 0 0	
,, July	1 8 1				7 13 5
,, October...	1 8 1		,, New Notice Boards ...		2 7 6
		5 12 8	,, Lockers in Dark Room ...		4 6 0
Payments for use of Locker in Dark Room		1 5 0	,, Repairs, &c., New Sheet...		0 11 1
			,, Lantern Slide Carrier ...		0 10 6
			,, Reading Lamp		0 4 0
			Balance forward		4 11 4
		£31 11 5			£31 11 5

	£ s. d.	£ s. d.
Balance brought down, at Bank ...	4 11 4	
Balance General Account, at Bank	59 10 3	
		64 1 7
		£64 1 7

EDWARD B. STURGE, *Treasurer*.

We, the undersigned, having examined the above Accounts and the Vouchers relating thereto, hereby certify that they are correct, according to the Vouchers, and to the Bankers' Pass Book.

JAMES EPPS, Jun.,
J. HENRY DRAGE, } *Auditors*.

January 8th, 1894.

CATALOGUE OF BOOKS IN THE LIBRARY

OF THE

Croydon Microscopical and Natural History Club.

Algæ, Fungi, &c., Collection and Preparation of. *Nave & Spicer.* 1869
Amber, On the Microscopical Structure of. *Sorby & Butler.*
Archæologia. *Society of Antiquaries, London.* 24 vols.
Archæology, The Progress of. *Dr. J. Evans.* 1891.
Archeopteryx, On Portions of a Cranium and Jaw of. *Dr. J. Evans.* 1881.
Austen, W. E., Memoirs of. *Frank Buckland.* 1877.
Anatomy, Physiology, &c., Researches in. *Gulliver.*

Ben Nevis Observatory, its Foundation and Work.
Berwickshire Naturalists' Club, History of. 2 vols. 1876—81.
Birds of Middlesex, The. *J. E. Harting.* 1876.
Birds' Eggs, Catalogue of Mr. P. Crowley's Collection of. 1883.
Birds, British, List of. *British Ornithological Union.* 1883.
Birds, Natural History of. *T. Rymer Jones.* 1867.
Birds, Eggs, and Nests. *Rev. J. C. Atkinson.*
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Birds, European, Handbook of. *J. Backhouse.* 1890.
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Botany, A Text-book of. *Julius Sachs.* 1875.
Botany, A Text-book of Structural. *Thomé.* 1878.
Bournes, On. *H. H. French.*
British Association, Address of President (*Sir J. Lubbock*). 1881.
British Association, Address of President (*Dr. Siemens*). 1882.
British Association, Reports 1883 to 1893. 10 vols.
British Association, Subjects for investigation by Local Scientific Societies.
Brighton and Sussex Natural History and Philosophical Society, Transactions of the. 1874—77.
Bromley and Keston, Round. *Half-Holiday Handbook.*
Butterflies, British. *J. O. Westwood.* 1860.

Callitriche polymorpha as a British plant. *W. H. Beeby.* 1888.
Camberley, Excursion to, described. *Geological Association.*
Cardiff, Handbook to. *British Association.* 1891.
Coral Reefs and Volcanic Islands. *Chas. Darwin.* 1890.
Coleoptera, American and North Mexican. *Austin.* 1880.
Coryphodon remains, Woolwich beds, Croydon. *H. M. Klaassen.*
Crab and Lobster Fisheries, Reports on. *Frank Buckland and others.* 1877.

Croydon, Chronicle of. *J. Corbet Andersen.* 1882.
Croydon to the North Downs. *Half-Holiday Handbook.*
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Cryptogamic Botany, Introduction to. *Rev. M. J. Berkeley.* 1857.

Darwin, Charles. *Nature Series.* 1882.
Deep Sea Explorations. *Pamphlet.*
Diatomaceæ, British. *Wm. Smith.* 1853—56. 2 vols.
Diatomées, Etudes sur des coupes de. *W. Prinz.* 1880.
Diatoms, Further Observations on the Movements of. *Jabez Hogg.* 1880.
Drifts of the Thames Valley. *Pamphlet.*

Earthquake, the East Anglian, of 1884. *Meldola & White.* 1885.
Earthquake, the great English. *Symons.* 1884.
Eastbourne Natural History Society, Transactions. 1 vol. 1875 to 1881.
Edward, Thos., Life of. (The Scottish Naturalist). *Dr. Smiles.* 1882.
Embryological and other delicate Organisms, Preparing for Microscopical Examination. *Ed. Lovett.*
Essex Naturalist, The. 5 vols. 1887 to 1891.

Ferns of York, The. *Hy. Ibbotson.* 1884.
Fishes, The Natural History of British. *Frank Buckland.* 1880.
Flint, Some Notes on. *J. Allen Brown.*
Flora, Handbook of the British. *G. Bentham.* 1865.
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Flora of Surrey, The. *A. Bennett.*
Fluids. *W. F. Stanley.* 1881.
Foraminifera, Introduction to the Study of. *W. B. Carpenter.* 1862.
Foraminifera of Down and Antrim, Recent. *J. Wright.*
Fossil Vertebrata, Supplement to Catalogue of British. *Woodward & Sherborn.* 1891.
Fungi and Wild Flowers, Manual of the Preservation of. *J. Lake English.* 1882.

Geological Congress, International. (Report of the British Sub-Committee). 1888.
Geological Excursions of the Geological Association. 1860 to 1890.
Geological Photography in Hertfordshire. *John Hopkinson.* 1890.
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Geology of Ealing, Evidences of Glacial Deposit. *J. Allen Brown.*
Geology of the Wandle and Ravensbourne Watershed. *J. W. Flower.* (Manuscript).
Geology and Geography of Western Canada. *W. Topley.* 1885.
Greenwich Astronomical Results. 1856, 1858, and 1873.
Greenwich Observatory: On the Value of the Moon's Semidiameter. 1864.

Histology, Lectures on. *John Quekett.* 1852.
Human Microscopic Anatomy. *A. Kölliker.* 1860.
Hunterian Oration: Royal College of Surgeons. *Gulliver.* 1883.

Hymenoptera, Remarks on the Hairs of some of our British. *Edwd. Saunders.* 1878.

Index Entomologicus. *W. Wood.* 1854.
Insects, American. *Thos. Say.* 1824—28.
Insects, Lepidopterous, Catalogue of the Indian Museum. *Horsfield & Moore.*
Invertebrates, Museum talk on. *Pamphlet.*

Lantern Slides, 293 presented by *Mr. Low Sarjeant.*
Lepidoptera of Middlesex, Thirty-six Hours Hunting among the. *G. J. Klein.*
Leuconid Calcisponge from the Middle Lias of Northamptonshire. *Dr. G. J. Hinde.* 1889.
Local Scientific Investigation, On. *John Hopkinson.* 1890.
London Geological Field Class, Report of Excursions, 1888.
Lower London Tertiaries, Section of, at Park Hill, Croydon. *H. M. Klaassen.*

Manchester Microscopical Society, Transactions. 1885 to 1890.
Meteorite, Fall of, near Middlesboro'. *A. S. Herschel.*
Meteorites, Catalogue of, in British Museum. *Pamphlet.*
Meteorological Observers, Hints to. *Royal Meteorological Society.*
Meteorology, Report of Committee of the Royal Society, 1873.
Micrographic Dictionary. *Griffith & Henfrey.*
Microscope, Cantor Lectures on the. *J. Mayall, Jun.* 1886.
Microscope, Essays on the. *G. Adams.* 1798.
Microscope, The Achromatic. *Richard Beck.* 1865.
Microscope, The. *L. Lane Clarke.* 1858.
Microscope, The. *Naegeli & Schwendener.* 1887.
Microscope, The. *W. B. Carpenter.* 1875.
Microscope and its Revelations, The. *W. B. Carpenter.* 1868.
Microscope, Practical Treatise on the use of the. *John Quekett.* 1855.
Microscope, How to work with the. *Lionel S. Beale.* 1868.
Microscope, How to work with the. *Lionel S. Beale.* 1875.
Microscope, Reports on the. *Pamphlets.*
Microscopic Objects, Preparing and Mounting of. *Thos. Davies.*
Microscopical Manipulation, On. *W. T. Suffolk.* 1870.
Microscopical Science, Studies in. *A. C. Cole.* 4 vols. 1883—87.
Microscopy, Practical. *G. R. Davis.* 1882.
Microspectroscope, Application of, to the Study of Evergreens. *Thos. Palmer.*
Migration of Birds, Report on. *Brown & Kermode.*
Moths, British. *J. O. Westwood.* 2 vols. 1843 and 1849.

Natural History, The Student's. *Wm. Baird, M.D.* 1863.
Natural History Objects, Notes on Collecting and Preparing. *J. E. Taylor.* 1876.
Naturalist's Voyage round the World in H.M.S. 'Beagle.' *Chas. Darwin.* 1889.
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Nomenclature, On. *W. H. Beeby.*
Norfolk and Norwich Naturalists' Society, Transactions. 2 vols. 1879 to 1889.

Northamptonshire Natural History Society, Journals. 3 vols. 1882 to 1887.

Octopus, The. *Henry Lee.* 1875.
Ostracoda from the Fuller's Earth, Oolite and Bradford Clay, On some. *J. Rupert Jones & C. D. Sherborn.* 1888.

Peruvian Bark. *C. R. Markham.*
Photographie, Traité de. *Lerebours.* 1843.
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Pictorial Effect in Photography. *H. P. Robinson.* 1886.
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Pictures of East Anglian Life. *Emerson.*
Podophthalma, Embryology of the. *Pamphlet.*
Polarized Light. *Chas. Woodward.* 1861.
Pond Life, Marvels of. *H. J. Slack.* 1871.
Portrait Photography, Practical. *Wm. Heighway.* 1882.
Public Health, Reports of. *John Simon.* 1887.

Quekett Microscopical Club, Journal of the. 5 vols. 1879 to 1891.

Rainfall, British. *G. J. Symons.* 12 vols. 1865 to 1870.
Rainfall, Systematic Observations and Record of. *G. J. Symons.*
Rosarius Year Book, The. *Rev. H. H. D'Ombrain.* 7 vols. 1877, 1879 to 1884.
Rotifera, The. *Hudson & Gosse.* 2 vols.
Royal Microscopical Society, Journal of the. 37 vols. 1868 to 1877, and 1879 to 1891.
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Science Gossip, Hardwicke's. 9 vols. 1881 to 1889.
Scientific Directory, International. *S. E. Cassano.* 1885.
Scientific Terms, Dictionary of. *W. M. Buchanan.* 1876.
Sea Fables Explained. *Henry Lee.* 1884.
Sea Marks, Our. *E. Price Edwards.* 1884.
Sea Monsters Unmasked. *Henry Lee.*
Selborne, Natural History of. *Gilbert White.* 2 vols. 1877.
Shells, Collectors' Manual of Land and Freshwater British. *L. E. Adams.* 1884.
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Shells, Recent and Fossil. *S. P. Woodward.* 2 vols. 1851.
Smithsonian Institute, Washington, Reports of. 7 vols. 1882 to 1886.
Societies, Year Book of Scientific and Learned. 2 vols. 1886—87.
Spectrum Analysis as applied to Microscopical Investigation. *W. T. Suffolk.* 1873.
Spectrum, A New Method of Measuring and Recording the Bands in the. *Thos. Palmer.*
Spectrum, Changes in, caused by Vegetable Colouring Matters. *Thos. Palmer.*
Subsidences on Blackheath. *Pamphlet.*

Valerians, On the Two. *W. H. Beeby.* 1888.

Vegetable Lamb of Tartary, The. *Henry Lee.* 1887.
Violas, On some forms of British. *W. H. Beeby.* 1889.
Vital Statistics. *Dr. Farr.* 1885.

Watford Natural History Society, Transactions of the. 2 vols. 1875 to 1878.
Weather at Addiscombe. *E. Mawley.* 5 vols. 1879 to 1884.
Weather Charts. *G. Corden.* 2 vols. in manuscript. 1867 to 1877.
West Kent Natural History Society, Reports. Vols. 1880 to 1891.
Westleton Beds of Suffolk, On their Relation to those of Norfolk. *Dr. J. Prestwich.* 1890.

Zoologist, The. 2 vols. 1883—4.
Zoology, Introductory Text-Book of. *H. A. Nicholson.* 1875.

The Committee will be pleased to lend the lantern slides, presented to the Club by Mr. Low Sarjeant, to Members, on application to the Librarian.

CATALOGUE OF BOOKS FOR REFERENCE.

The Late Dr. Carpenter's Collection.

Annelids, Monograph of the British. *McIntosh.* 2 vols.
Aphides, Monograph of British. *Buckton.* 4 vols.

Bibliographia Zoologiæ. *Agassiz.* 4 vols. (Ray Society).
Botanical Geography. *Meyen.* (Ray Society).
Botanical and Physiological Memoirs. (Ray Society).
Botanical Works of Robert Brown, Miscellaneous. 2 vols. And Atlas of Plates. (Ray Society).
Botany. *Withering.* 4 vols.
Botany, Reports and Papers on. 2 vols. (Ray Society).
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Butterflies and Moths, Larvæ of British. *Buckler.* 3 vols.

Carex, Illustrations of the Genus. *Boott.* 4 vols. (Ray Society).
Cetacea, Recent Memoirs of the.
Cirripedia, Monograph of the. *Darwin.* 2 vols. (Ray Society).
Collembola and Thysanura, Monograph of. *Lubbock.* (Ray Society).
Copepoda, Monograph of British. *Brady.* 3 vols. (Ray Society).
Cryptogamia, Higher. *Hofmeister.* (Ray Society).

Entomostraca, Natural History of British. *Baird.* (Ray Society).

Foraminifera, Introduction to the Study of. *Carpenter.*
Foraminifera, Recent. *Williamson.*

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Gymnoblastic Hydroids, Monograph of the. *Allman.*

Hemiptera-Heteroptera, British. *Douglas & Scott.* (Ray Society).
Hymenoptera, Monograph of British Phytophagous. *Cameron.* 2 vols.
Hydrozoa, Oceanic. *Huxley.*

Lichens, Angiocarpous. *Leighton.* (Ray Society).

Medusæ, British Naked-eyed. *Ed. Forbes.*
Mollusca, Nudibranchiate. *Alder & Hancock.* 7 vols.

Oribatidæ, British. *Michael.* 2 vols.

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Physiophilosophy, Elements of. *Oken.* (Ray Society).
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Ray, Correspondence of. (Ray Society).
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Reptiles of British India. *Günther.*
Royal Society, Abstracts of Proceedings. 1801 to 1873. 21 vols.

Selecta Fungorum Carpologia. *Tulasne.* 3 vols.
Shells, Bone, &c., Formation of. *George Rainey.*
Shoulder-girdle and Sternum, Structure and Development of, in the Vertebrata.
Spiders of Great Britain and Ireland. *Blackwall.* 2 vols.
Spongiadæ, Monograph of British. *Bowerbank.* 4 vols. (Ray Society).

Trilobites, Organization of. *Burmeister.*

Vegetable Teratology. *Masters.* (Ray Society).

Zoology, Reports on. (Ray Society).

LENT BY MR. MENNELL.

British Ferns. *Newman.*
British Poisonous Plants. *Sowerby & Johnson.*

Flora of Essex. *Gibson.*
Frog, The Common. *St. George Mivart.*

Insects, Origin and Metamorphoses of.

Meteorology. *Daniel.* 2 vols.

Natural History Review. 3 vols.
Northumberland and Durham Natural History Society, Transactions of the. Vols. 1 to 7.

Rusticus, The Letters of. 1849.

Tyneside Naturalists' Field Club, Transactions of the. Vols. 1 to 6.

Vertebrata, Handbook of the Yorkshire.

TRANSACTIONS

OF

THE CROYDON MICROSCOPICAL AND NATURAL HISTORY CLUB.

1893–94.

110.—Earth Temperatures.

By Dr. H. Franklin Parsons, F.G.S.

(Read February 8th, 1893.)

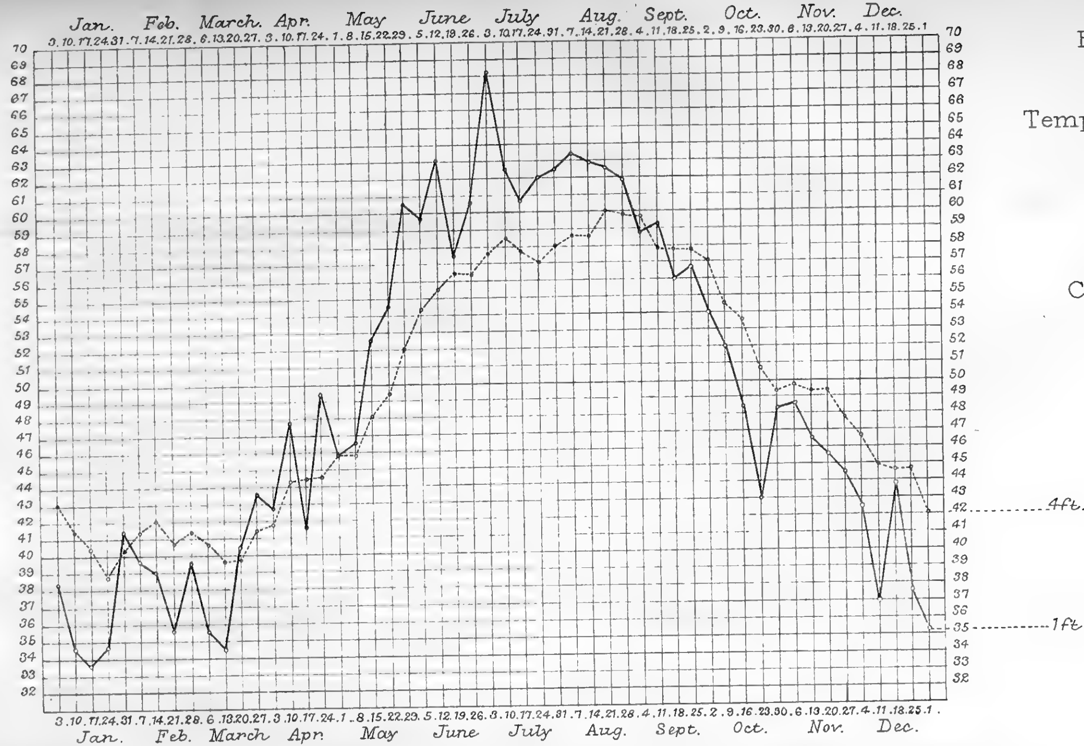
As a small contribution to the proceedings of the Croydon Microscopical and Natural History Club, which has done me the honour to elect me as its President, I submit some observations which I have made during 1892 on the seasonal variations of the temperature of the earth at depths of 1 ft. and 4ft. below the surface. But as these by themselves would be rather a meagre bill of fare to set before you, I propose to supplement them by a short sketch of what is known as to the temperature of the upper layers of the earth at different seasons and different depths. My observations were made at Park Hill Rise, at an altitude of about 250 ft. above the sea, under grass, the soil being stiff clay (a small outlier of the London clay). The thermometers were made specially for me by Mr. Denton of Hatton Garden. The bulb is enclosed in an outer shell to retard the movement of the mercury, so that it may not change during the act of withdrawal and reading. The thermometers are graduated on the stem, each degree measuring $\frac{1}{14}$ in. They have not been verified at Kew, but when placed together in a water bath the readings of the two agree to a tenth of a degree Fahr. They are let down by brass chains into pieces of iron gas-pipe driven vertically into the ground to the required depth; one end of the chain is attached to a loop on the top of the thermometer, the other to a cork, which closes the upper end of the tube, over which a flower

saucer is inverted. I have since thought that it would have been better if the pipe for the shallower thermometer had been placed obliquely, sloping to the north, so that the bulb of the thermometer should have been at the depth of a foot, and have had the earth and grass directly above it. The readings were taken once a week, on Sunday mornings between 9 and 10 a.m.; the maximum and minimum air-temperatures during the preceding week being taken at the same time. These were taken by a Six's thermometer hung against a north wall of my house. The readings of this thermometer have been compared, by immersion in a bath, with those of the earth thermometers, and corrected accordingly, so that they correspond to about 1° F. The average of daily observations would no doubt have given a truer approximation to the mean temperature of the week, but frequent absences from home in the early part of the year prevented my attempting observations more often than once a week. The mean temperature of the year (48·6°) thus obtained is about the same as at Greenwich, *viz.*, 48·3°; but the weekly readings are higher than the Greenwich means in summer and lower in winter.

The results of my observations are given in the accompanying table and diagram.

Date.	Croydon.					Greenwich (week ending previous day).	
	Earth.		Air.			Air.	
	1 ft.	4 ft.	Max.	Min.	Mean.	Weekly Mean.	Average of 20 years.
Jan. 3, 1892	38·1°	43·0°	55°	20°	37·5°	43·0°	38·5°
„ 10	34·9	41·6	45	23	34	33·1	37·7
„ 17	33·9	40·5	37	21	29	30·8	38·1
„ 24	34·9	38·9	51	29	40	37·4	39·1
„ 31	41·4	40·2	53	29	41	42·7	40
Feb. 7	39·6	41·1	52	29	40·5	41·5	40·6
„ 14	39·0	42·0	54	29	41·5	43·3	39·4
„ 21	35·5	40·9	45	19	32	30·7	39·1
„ 28	39·2	41·1	55	32	43·5	40·9	39·8
March 6	35·6	40·8	43	23	33	33·5	40·4
„ 13	34·6	39·6	41	22	31·5	31·6	40·7
„ 20	40·2	39·9	60	24	42	41·4	41·2
„ 27	43·7	41·1	60	31	45·5	41·4	41·7
April 3	42·8	41·9	68	28	48	42·7	44·3
„ 10	47·9	44·2	74	31	52·5	53·4	46·6
„ 17	41·7	44·3	67	26	46·5	41·3	47·2
„ 24	49·2	44·5	70	29	49·5	47·1	48·1
May 1	45·9	45·9	65	29	47	45·1	48·5
„ 8	46·5	45·7	62	29	45·5	44·7	49·5
„ 15	52·7	48·0	72	39	55·5	55·4	51·5
„ 22	54·4	49·6	69	42	55·5	53·9	54
„ 29	60·5	52·0	85	48	66·5	62·8	55·9

1892



Earth Temperatures at Croydon.

West, Newman sc.

Date.	Croydon. Earth. 1 ft.	Earth. 4 ft.	Air. Max.	Air. Min.	Air. Mean.	Greenwich (week ending previous day). Air. Weekly Mean.	Air. Average of 20 years.
June 5, 1892	59·7°	54·1°	87°	45°	66°	60·6°	57·5°
,, 12	63·0	55·7	85	49	67	61·9	58·5
,, 19	57·3	56·2	66	38	52	51·3	59·3
,, 26	60·5	56·2	77	45	61	57·5	61·0
July 3	68·0	57·6	83	43	63	63·2	61·7
,, 10	62·5	58·4	80	51	65·5	63·1	61·8
,, 17	60·5	57·5	77	51	64	57·8	63·1
,, 24	61·9	57·0	74	48	61	56·4	63·1
,, 31	62·2	58·0	76	49	62·5	59·4	62·6
Aug. 7	63·2	58·5	79	49	64	60·8	62·7
,, 14	63·5	58·5	80	43	61·5	60·6	62·6
,, 21	62·7	60·0	84	50	67	63·9	61·9
,, 28	61·9	59·7	81	49	65	62·8	61·1
Sept. 4	58·6	59·2	73	45	59	58·3	60·3
,, 11	58·8	57·9	66	38	54	53·8	59·1
,, 18	56·0	57·8	73	37	55	58·3	57·6
,, 25	57·0	57·6	73	40	56·5	58·0	56·4
Oct. 2	52·0	57·0	67	38	52·5	53·9	55·3
,, 9	49·0	54·5	62	40	51	47·3	53·3
,, 16	48·5	53·2	59	34	46·5	46·8	51·8
,, 23	43·0	50·6	52	31	41·5	41·9	50·8
,, 30	48·5	49·1	59	25	42	44·9	48·8
Nov. 6	48·7	49·5	57	30	43·5	47·7	46·7
,, 13	46·7	49·0	54	27	40·5	44·3	43·8
,, 20	45·8	49·2	60	30	45	47·6	43·4
,, 27	44·3	47·8	50	28	39	41·3	41·1
Dec. 4	42·5	46·9	52	29	40·5	42·6	41·3
,, 11	37·0	44·9	42	26	34	43·8	41·5
,, 18	43·0	44·7	54	28	41	43·8	41·5
,, 25	37·7	44·5	48	19	33·5	38·8	39·6
Jan. 1, 1893	35·6	42·0	34	15	24·5	28·2	38·8
Mean	48·9	49·2	63·1	34·0	48·6	48·3	49·6

From this table we may learn—

1. That the mean temperature of the air was 48·6° F., of the earth at 1 ft. depth 48·9°, and at 4 ft. depth 49·2°, showing a slight increase with depth.

2. That the highest reading of the 1 ft. thermometer was 68° F. on July 3rd, and the lowest 33·9° on Jan. 17th; a range of 34·1°.

It is of practical importance to observe that the temperature a foot below the surface never fell so low as 32° F., as showing that water-pipes buried at that depth are not likely to be often blocked by frost.

3. That the highest reading of the 4 ft. thermometer was 60·0° F. on Aug. 21st, and the lowest 38·9° on Jan. 24th; a

range of only 21.1°, as against a range of 34·1° at 1 ft. and 72° in the air.

4. That the movement of the 4 ft. thermometer was much more equable than that of the 1 ft. one; the former exhibiting few fluctuations, and never a difference of so much as 3° between the readings of successive weeks, whereas the latter exhibits many ups and downs, and sometimes differences of over 7° in successive weeks.

5. That in its movement the 4 ft. thermometer lags behind the 1 ft. one, being below it in spring and summer, and above it in autumn and winter.

The results, so far as they go, are in accordance with the vastly more extended observations made at Greenwich Observatory during the 27 years (1847–73), and at depths ranging from one inch to 8 metres = 25·6 ft. The results of these observations are shown as monthly means on another diagram.

The mean yearly temperature of the air during the period was 49·43°

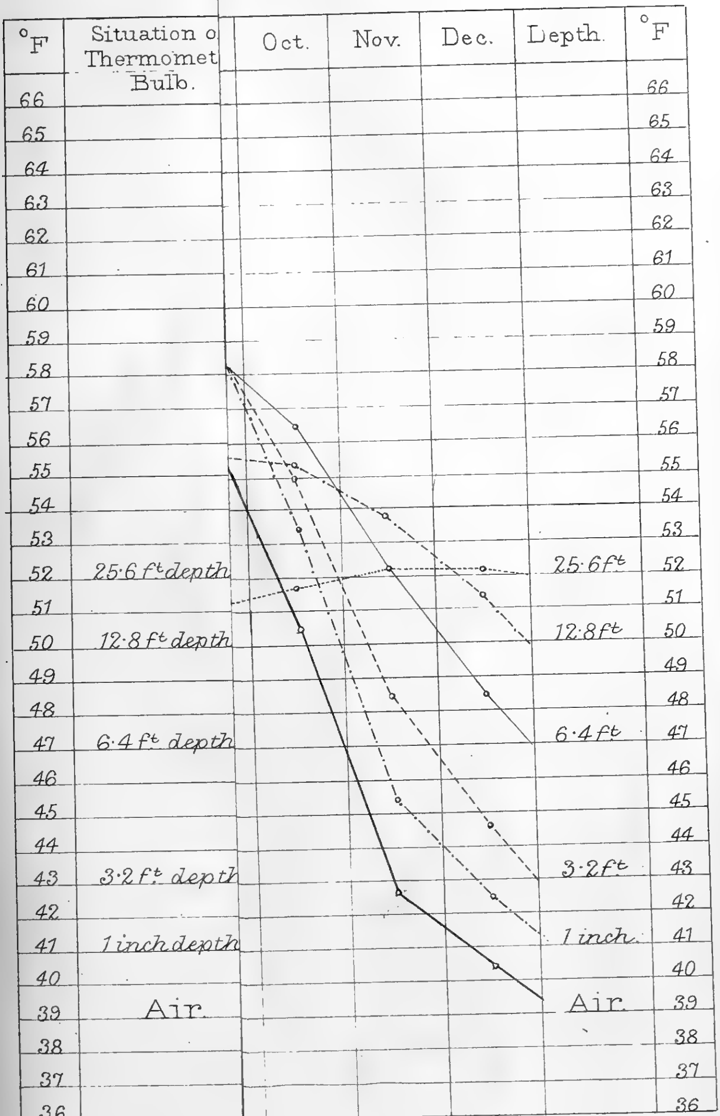
Of the earth at one inch depth,				51·97°
,,	,,	3·2 ft.	,,	51·19°
,,	,,	6·4 ft.	,,	51·69°
,,	,,	12·8 ft.	,,	50·89°
,,	,,	25·6 ft.	,,	50·56°

The movement of the temperature at one inch depth was nearly parallel to that of the air, but it was higher throughout by 2° in winter and 3° in summer. At the greater depths the movement of the temperature was retarded in proportion to the depth. Thus, while the highest monthly mean in the air was attained in July, that of the earth at 3·2 ft. was attained in August, at 6·4 ft. in August and September, at 12·8 ft. in September and October, and at 25·6 ft. in November and December. Conversely, the lowest monthly mean was attained in the air in January, at 3·2 ft. depth in February, at 6·4 ft. depth in February and March, at 12·8 ft. in March and April, and at 25·6 ft. in May and June. Thus, owing to the bad conducting properties of the earth, the annual heat-wave takes four or five months to reach to a depth of 25 ft.

The temperature also becomes more equable in proportion to the depth. Thus, while the monthly means of the air temperature vary through a range of 24°, those of the thermometer at 3·2 ft. range through 21°, at 6·4 ft. through 15°, at 12·8 ft. through 9°, and at 25·6 ft. through little more than 3°. At a greater depth it may be expected that we should meet with a practically equable temperature, unaffected by the seasons, and not far distant from the mean temperature of the locality.

Our distinguished member, Mr. Baldwin Latham, tells me that he has for a number of years made observations with earth

TURES
1873.



°F
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25·6 ft depth
12·8 ft depth
6·4 ft depth
3·2 ft depth
1 inch depth
Air.
25·6 ft
12·8 ft
6·4 ft
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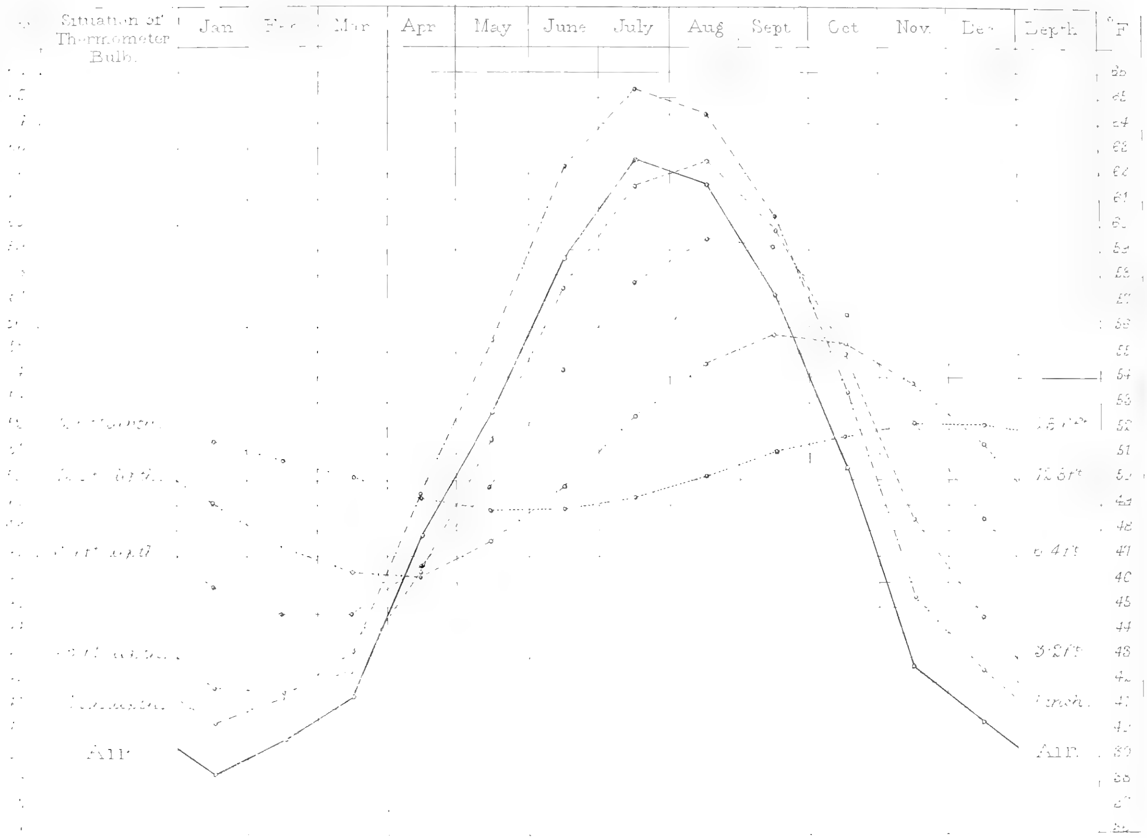
1 inch.
Air.

GREENWICH.

Mean Monthly EARTH TEMPERATURES during 27 Years 1847 – 1873



thermometers at Addiscombe, at depths up to 50 ft., and that he finds that the seasonal changes of temperature do not extend so deep as 40 ft., but that even at 50 ft. there are slow changes of small amount extending over a series of years.

Neither the Greenwich observations nor my own show the diurnal range of temperature, but some information on this point is given by Mr. G. T. Symons in an Abstract of Meteorological Observations made in the Royal Botanical Society's Gardens, Regent's Park, during the years 1871–76. These observations were made three times daily, *viz.*, at 9 a.m., 3 p.m., and 9 p.m., and at depths of 3, 6, 12, 24, and 48 in. The means for the period were as follows:—

Depth.	Mean of all readings for the period 1871-6.			Extreme readings during period.		Range of Monthly Means.
	9 a.m.	3 p.m.	9 p.m.	Highest.	Lowest.	
Air	50·1°	55·3°	49·1°			
3 inches	49·0	55·0	50·5	93·0°	26·2°	31·3°
6 inches	48·9	52·8	51·6	84·0	31·0	29·4
1 foot	49·2	49·9	50·5	77·2	32·0	26·5
2 feet........	49·5	49·5	49·5	67·3	33·0	22·6
4 feet........	50·1	50·1	50·0	66·0	37·0	18·9

These observations show that the course of the daily heat-wave through the badly conducting earth resembles that of the annual heat-wave, as shown by the Greenwich observations, only that it does not extend so deep, not reaching to a depth of 2 ft. It will be seen that of the three times of observation the air temperature is highest at 3 p.m., and is lower at 9 p.m., when the sun is down, than at 9 a.m., when the sun is above the horizon. At 3 in. depth the mean temperature is also highest at 3 p.m., but is higher at 9 p.m. than at 9 a.m., indicating that the highest point during the day must have been attained after 3 p.m.; and this is still more the case at 6 in. depth, while at 1 ft. depth the highest temperature of the 24 hours appears to be attained at 9 p.m.

There is a difference between the conducting power of different soils, light dry soils being worse conductors than dense clay soils. Hence the former are subject to greater extremes of temperature at the surface than the latter, but the heat and cold do not penetrate so far down. This helps to explain how it is that some plants, such as wallflowers, will stand the winter on dry soils, but are killed by severe frost in clay soils, the frost in the latter case penetrating sufficiently deep to kill the spongy

rootlets which are the means of nutrition of the plant. For a similar reason plants which are well rooted will bear a frost which would kill those which have been recently transplanted, the rootlets of the former having penetrated to a sufficient depth to be out of harm's way.

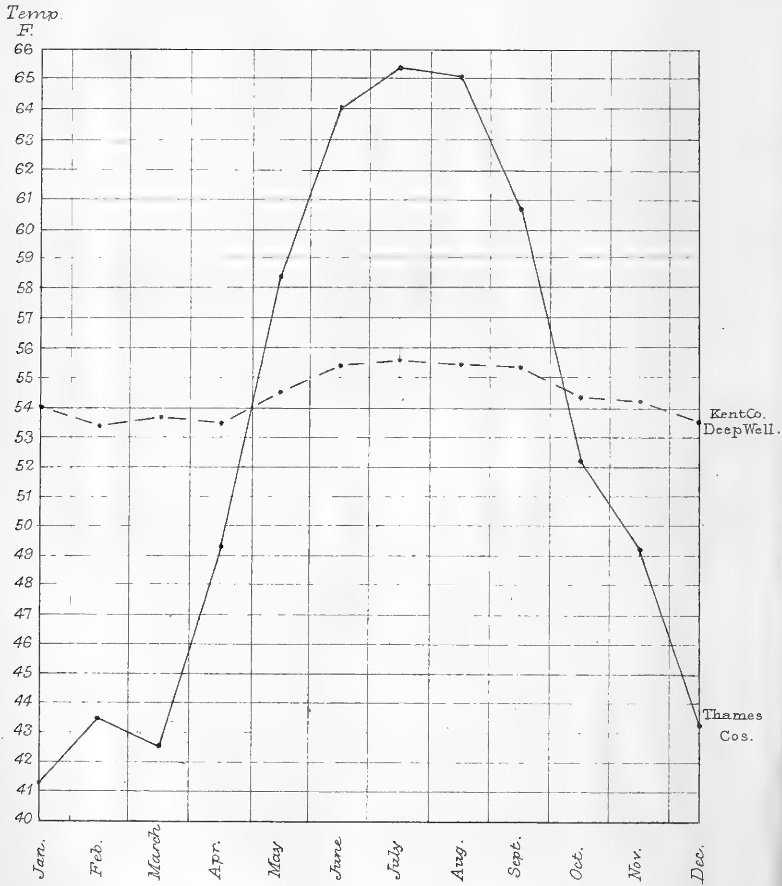
The seasonal growth of plants, and especially of bulbous and other plants which send up annual stems from perennial roots, is doubtless largely dependent upon the temperature of the soil, probably as much as upon direct solar heat or air temperature. With most of our indigenous plants probably growth does not commence until a temperature of about 42° F. has been reached. This is a direction in which much useful knowledge is likely to be gained by a combination of phenological and earth temperature observations.

The combination in autumn of moisture and plentiful decaying organic matter, with a high ground temperature, is probably the cause of the abundant development of fungi at that season in our woods and fields. Similar causes probably account for the seasonal prevalence in autumn of certain diseases, as typhoid fever and diphtheria, which are believed to be produced by bacteria of kinds capable of living outside the human body as well as within it. In at least one disease, *viz.*, the epidemic diarrhœa, which occasions such a heavy mortality among children in some of our large towns, a definite connection with earth temperature conditions has been made out. On this point my former colleague, Dr. Ballard, says:—"The summer rise of diarrhœa mortality does not commence until the mean temperature recorded by the 4 ft. earth thermometer has attained somewhere about 56° F., no matter what may have been the temperature previously attained by the atmosphere or recorded by the 1 ft. earth thermometer. The maximum diarrhœa mortality of the year is usually observed in the week in which the temperature recorded by the 4 ft. earth thermometer attains its mean weekly maximum. The decline of the diarrhœa mortality coincides with the decline of the temperature recorded by the 4 ft. earth thermometer, which temperature declines very much more slowly than the atmospheric temperature, or than that recorded by the 1 ft. earth thermometer; so that the epidemic mortality may continue, although declining, long after the last-mentioned temperatures have fallen greatly." Possibly, as Mr. Baldwin Latham has suggested, the temperature of the drinking water may be concerned in the production of summer diarrhœa, but this temperature is largely dependent upon that of the earth.

The water of a moderately deep well, say, 50 ft. deep, is approximately constant at about the mean yearly temperature of the locality, but the water from superficial sources, such as rivers and open reservoirs, varies greatly in temperature with the

Mean Monthly Temperatures of London Water Supplies as drawn from the mains.

Average of 9 years 1884–92.



West, Newman sc.

season (Mr. Symons, in a series of observations already quoted, found the water of the lake in Regent's Park to range in temperature between 80° and 29° F.). I have arranged, in the form of a diagram, the mean monthly temperatures of London water supplies for the nine years 1884–1892, as given by Dr. Frankland in the Registrar-General's Weekly Returns for those years. In this diagram the temperature of the Kent Company's water, which is drawn from deep wells in the chalk, is represented by a dotted line, and the average temperatures of the water of the companies deriving their supply from the Thames by a thick line. These temperatures, however, are those of the water as drawn from the mains, and do not represent it as delivered to consumers, for in its passage through the smaller branches of the system the water will doubtless have to a considerable extent approximated its temperature to that of the soil in which the pipes are laid. Still the difference in temperature between the deep-well water of the Croydon Corporation and the Thames water of the Lambeth Company is, I find, sufficiently perceptible when one takes one's morning tub, the former being comparatively equable in temperature, the latter icy cold in winter and lukewarm in summer.

The water of deep springs, such as those which issue from the chalk at Waddon, is similarly equable in temperature, having about the mean temperature of the year; hence it feels deliciously cool in summer, while it steams on a frosty day, and keeps aquatic plants in verdant growth all through the winter.

When the temperature of the earth at depths below that at which the influence of the seasons ceases can be ascertained, as in mines, deep wells and borings, and tunnels, it is found to increase steadily with the depth, though the rate of increase varies considerably in different places. The Underground Temperatures Committee of the British Association made, in 1882, a report, giving a summary of the best observations which had been made up to that date. In thirty-six such observations quoted the rate of increase of temperature with the depth varied from 1° F. in 130 ft. in a deep well at Liverpool, to 1° F. in 34 ft. in a mine in Weardale. The rate of increase, however, was usually similar in observations made in the same neighbourhood; thus, in artesian wells in the neighbourhood of London and Paris it was 1° in about 56 ft.; in the deep collieries of the coalfield east of Manchester it was 1° in 77 ft. The differences in the rates of increase in different cases may partly be explained by differences in the nature of the rocks or configuration of the surface. In compact rocks the heat conductivity is greater, and the increase of temperature with depth consequently slower than in looser and softer beds. Again, in laminated rocks the heat conductivity is greater in the direction of the layers than across them; hence in stratified rocks dipping at a high angle, the

increase with depth is slower than where the beds are level. In some cases local irregular increases of heat in mines appear to be due to the oxidation of pyrites. Under high ground, as in the St. Gothard and Mont Cenis tunnels, the temperature rises, but not with a gradient so steep as that of the surface. The mean deduced by the Committee from the thirty-six sets of observations was 1° increase in 64 ft., or over 82° per mile.

At this rate, at a depth small in comparison to the diameter of the earth, say, 100 miles, a temperature would be reached at which all substances which we know would be melted or volatilised, and from the fact of the temperature increasing with the depth, the conclusion was formerly drawn that the interior of the earth must be a mass of molten matter, enclosed like an egg within a thin shell of solidified rock. Mathematicians, however, say that the rigidity of the earth must be equal to that of steel, or the equatorial bulging caused by its rotation on its axis would be greater than it is. Hence the physical condition of the interior of the earth must be looked on as a problem which is not yet solved, and perhaps never will be. The enormous pressure in the interior of the earth is a factor altogether beyond our experience.

The geo-isotherms or planes of equal temperature in the earth's crust cannot be everywhere equally distant from the centre; they will be depressed under the oceans and polar regions, and elevated under mountains and high plateaux, in volcanic regions, and in the tropics. At Yakoutsk, in Siberia, the earth is permanently frozen at a depth of 540 ft., whereas at Trevandrum, in India, the mean temperature at a depth of 12 ft. is found to be 86°.

The heat of the interior of the earth, coupled with great pressure and the probable presence of superheated water acting during the ages of geologic time, must powerfully modify the physical and chemical structure of the materials of the earth; and when we remember that the more ancient rocks which are known to us must have been brought to the surface by movements of the earth's crust after having been at one time covered by strata several miles in thickness which have subsequently been denuded, we need not wonder at these early rocks having lost almost all traces of their original structure, and become profoundly altered and metamorphosed into crystalline materials.

The temperature of the ground at any given depth is mainly derived from two sources, *viz.*, the rays of the sun and the earth's internal heat, the temperature of the superficial layers depending almost entirely upon the former source, while the latter becomes appreciable at the greater depths explored by geologists. There may be other subsidiary sources, such as chemical changes and the heat produced by unequal pressures.

A heap of rotting manure will attain a heat of 120° F., and the decay of fallen leaves and other organic matter must help, however slightly, to raise the temperature of the superficial layers of the soil. The oxidation of pyrites, which we know will sometimes generate heat sufficient to set the spoil-heaps at collieries on fire, is believed to affect the temperature in mines. The crushing of rock by local strains also develops heat, and is believed to be the source of volcanic action. All these sources of heat, however, like other forms of energy on the earth, may be traced back to one or other of two sources, *viz.*, the sun's radiation and the earth's original stock of energy.

111.—The Silkworm Disease; its Cause and Prevention.

By A. B. Farn.

(Read April 12th, 1893.)

I have been honoured by a request to read a paper before your Society, and have thought that, in complying with that request, I would try to interest you by placing before you as concisely as possible an account of Pasteur's researches as to the cause, and prevention, of the silkworm disease, rather than attempt anything original. Although the rearing of silkworms in this country can scarcely be called one of the industries, yet the results of silkworm rearing in other countries must indirectly interest the commerce of this country. No less than £2,000,000 sterling is the value of the silk raw or manufactured imported into this country annually. There being no large rearing of silkworms here would seem to account for the fact that M. Pasteur's report on the disease does not seem to have received very general attention in this country, nor, so far as my recollections carry me, does there seem much need to intervene as regards that particularly hardy race of silkworms which is still, I believe, occasionally reared in this country. In one's school-days, I remember, each boy would at certain periods turn himself into a sort of perambulating incubator, carrying during the daytime, in his waistcoat pocket, or even next his skin, a small piece of flannel containing some score or more silkworms' eggs, and at night trying to maintain a more or less uniform temperature by placing them under his pillow. Then, too, with childish impatience, he would, if a worm had but the temerity to show his black head through the side of an ovum, endeavour to assist nature and bring about a premature delivery by the aid of a

needle or a pin. The newly-disclosed worm thus incontinently dragged into existence had to comfort itself with lettuce-leaves, and these sometimes by no means of a succulent nature; and he was a lucky worm indeed which survived until mulberry-leaves came in, and then he had but the coarse leaves of the *black* mulberry; the tender, fine-textured, leaves of the *white* mulberry never entered into his wildest dreams. Yet, despite rough handling and indifferent food, some worms survived to produce a very fair cocoon. If we believe in the survival of the fittest, —and the race is still continuing in schoolboy hands,—I very much doubt whether now anything less than a sledge-hammer could seriously injure it.

But on the Continent, where silkworms were reared by myriads and every care was taken of them, it sometimes happened that entire broods died before reaching maturity. The eggs carefully retarded in development by being kept in a cool place until the tender leaves of the white mulberry were sufficiently advanced; the larvæ reared in houses constructed on scientific principles, neither too hot nor too cold, and properly ventilated, surrounded by everything that experience could dictate for the advantage of the worm; yet meeting with nothing but disaster. In France, so terrible was the mortality of the worms, that the annual crops of cocoons had fallen from 26,000,000 kilogrammes to 4,000,000 kilogrammes, causing a loss of at least £4,000,000 sterling in one year alone. Events seemed to point to the total extinction of the silkworm. Nurserymen, who were rearing the white mulberry-trees to transplant to the silk-rearing localities, found themselves almost bankrupt. Trade in the South of France suffered generally, for the most important debts incurred during the year were usually satisfied after the silk harvest; and one can readily imagine all sorts of ramifications of distress when the silk crop proved a failure.

All rearers of silkworms had at times lost their broods from a cause they could readily understand, but here was a disease as mysterious in its operations as it was fatal. When healthy worms are approaching maturity they eat incessantly, taking in an enormous quantity of food, of which a very large proportion is fluid. The only way the larvæ can dispose of this fluid (as they do not urinate) is by an imperceptible evaporation, through their skins, and anything which checks or suppresses this evaporation is deadly to the larvæ. In warm humid weather, when the atmosphere is saturated by moisture, unless the temperature of the rearing-houses is maintained so that the air therein is kept artificially dry, the worms can no longer dispose of the superfluous moisture within them. The contents of their alimentary canal forthwith ferment, and the larvæ are seized with diarrhœa, turn rapidly black and putrefy. This disaster, how-

ever, was intelligible to the sericulturist. In consequence of sea-fogs, when the air is laden with moisture, the rearing of silkworms is not attempted near the sea. I have seen the rearing of silkworms recommended as an Irish industry, as the soil and climate would suit the mulberry-tree; the fact that the humidity of the climate would be prejudicial to the silkworm had been overlooked. But the disease which persistently and universally attacked the rearings year after year, which baffled all treatment, and which promised nothing but ruin, was apparently beyond discovery as to its nature until Pasteur undertook the enquiry. When first requested to do so he hesitated, not only having other important investigations under weigh, but, as he himself expressed it, "I know nothing about silkworms; I do not think I have ever even seen one." The rejoinder to this was, "So much the better; you will enter into the investigation with an open mind." An "open mind," by the way, seems to be very much in vogue at the present day with certain people, and on all sorts of subjects too. However, M. Pasteur commenced the investigation of the disease, and I will endeavour to place before you as shortly as I can the results he obtained.

When one speaks of *the* disease, one refers to Pébrine, about to be described, and when one speaks of silkworms, one refers to the larvæ of *Bombyx mori*; Pébrine being the most important disease as *Bombyx mori* is the silk-producer *par excellence.*

Our English peasant or labourer keeps a pig or a few fowls to eke out his income, but in South France peasants and others rear silkworms instead, investing their money in rearing-houses and appliances, and in growing mulberry-trees.

In years before Pébrine—or the pepper disease, one of its symptoms being the appearance of small black spots resembling pepper scattered over the worms,—before, I say, this disease became such a scourge, each rearer of silkworms retained, at the end of the season, some of the finest cocoons he had reared for the purpose of continuing the breed. He thus sacrificed a certain amount of silk to ensure eggs from healthy parents; for the silk of cocoons devoted to this purpose was not wound off, and the moth freed itself in the natural way by making a hole in the cocoon from which it emerged. Each rearer therefore provided himself with seed from year to year from moths he had himself reared, and of whose health he had been assured. Had this course but continued, little probably would have been heard of Pébrine, except as quite a casual disease.

But some ingenious individual conceived the idea of rearing silkworms, not for the silk they produced, but solely for the eggs which the moths would produce. Thus was started a trade which supplied eggs in almost any quantity, and so cheaply that the individual peasant no longer sacrificed any of his cocoons to

the moths, but reeled off all his silk, and went to the egg-rearer for his next year's supply of seed. This new departure was the primary cause of the resulting terrible loss to the silk-rearers, although it was a trade profitable enough to the egg-rearers. Under this fresh division of labour things went smoothly enough for a year or two, and then came almost total failure of the silk crop. The seed which had been so successfully reared to silk suddenly became bad in the extreme, and the strain obtained an unenviable fame. The seed-rearers went further afield into districts where the healthiness of the silkworms promised a supply of healthy seed; for a year or two this fresh locality furnished excellent seed, to be again followed by disaster once more. Driven from this place, the seed-merchant then made a fresh start somewhere else, and again history repeated itself—disaster in two or three years. Always extending their sphere of operations, the seed-merchants were always attended by disease within a short period, and with almost total failure of the worms hatched from the eggs they supplied. France, Spain, Italy, Syria, the Caucasian Provinces, Wallachia, Moldavia, and other countries were in turn invaded by the seed-merchants, to be closely followed by the disease, until at last it was to Japan alone that the seed-merchants could look for good seed. China would have nothing to say to them, and wisely, and they could not obtain a footing in that country.

Pasteur attributes, and rightly, the extension and intensity of Pébrine to the following:—There had always been a certain amount of the disease among silkworms, but causing only a relatively trifling amount of damage; and this damage would have doubtless continued but trifling if each silk-rearer had adhered to that good old plan of each year saving some of his healthiest cocoons for eggs. As I have before remarked, he then knew the family history, and that upon the healthiness of the eggs depended his silk harvest of the ensuing year, and he took his precautions accordingly.

But with the seed-merchant it was far otherwise; he had no concern as to the production of silk, and could view with a certain amount of equanimity failure of the silk crop, provided he had an enormous number of eggs to sell. The larger the number of eggs the more he could sell, and so in rearing-houses, having no failure of silk before his eyes, he would rear two, three, or more ounces of seed where a prudent silk-rearer, realizing the damaging effect of overcrowding of silkworms, would have accommodated but one ounce of seed. And Pébrine, ever present, though under normal conditions of rearing a disease of no great moment, became in these overcrowded houses developed to a degree which in a few years threatened ruin to the silk-rearers who purchased seed from these overcrowded houses.

The evils resulting from overcrowding of human beings have often received the attention of your worthy President, and he doubtless could give you many instances where disease has become epidemic in consequence.

This new industry of rearing silkworms from seed therefore brought about almost total annihilation of the worm. Indeed, I am not sure whether at the present time there is remaining even a remnant of that variety of the silkworm which produced the large shuttle-shaped cocoon of pale or of dark yellow silk of great substance and lustre. The Japanese variety produces a sort of bilobed cocoon, being slightly constricted round the centre, and a silk of pale greenish yellow, wanting both the substance and lustre of the old Italian and French race. By substance I mean the thickness of the individual thread forming the cocoon. This is shown by the following fact: You are doubtless aware that for commercial purposes the silk of each cocoon is not reeled off separately, but three, four, five or more cocoons are wound simultaneously: the thread from each, by giving a rotary motion to the cocoons as they float on warm water forms one large thread. Six cocoons of the Japanese variety are required to form a thread equal to that produced from four cocoons of the other variety. Perhaps a slight digression on the subject of reeling the silk may not be out of place here. Even in those palmy days of sericulture, before Pébrine became a scourge and egg-rearing an industry, the Italian silk had a higher reputation than French silk, although the produce of a precisely similar variety of silkworm, the difference being due entirely to the mode of reeling the silk from the cocoons adopted in the two countries. In France each rearer was free to do as he liked in the matter of reeling, and so each one wound for himself the silk from the cocoons he had reared. In consequence there was no uniformity. One man might reel the produce of three cocoons, another of four, and a third of five cocoons together. Besides, some would be more expert or more careful than others in maintaining a uniform thread by at once replacing a spent cocoon by a fresh one as the reeling went on, or more careful in eliminating all "foul" silk from the thread. Foul silk is the technical term for that loose envelope of silk surrounding the true cocoon, and which, being very difficult to reel, forms kinks and knots. It is evident therefore that the silk of each rearer might vary considerably, as indeed it did. The silk thus reeled was bought up by itinerant merchants, who sorted out the productions as well as they could, and sold the sorted silk either to larger merchants or to manufacturers.

In Italy, on the other hand, the silk rearer was forbidden by law to reel the silk the worms he had reared had produced unless he was specially licensed for the purpose. Reeling silk was a

business of its own, and quite apart from worm-rearing. The reelers bought the cocoons from the rearers, and reeled off the silk. The reeler's license specified how many cocoons he should use in making a thread, and departure from this condition was unlawful. The silk produced therefore from any one reeling-house was always the production of the simultaneous reeling of the same number of cocoons, and frequently the whole of the cocoons of one district went to one reeling-house. To this alone may be attributed the superiority of Italian silk.

We have seen the cause which intensified the Pébrine disease. Now to learn from Pasteur something as to the disease itself. Before he made his enquiry other investigators had observed that Pébrine was accompanied by small, shining, microscopic bodies within the affected worms, and that the black spots of the disease seemed to be due in some change in the skin where these shining bodies were located. But it was left to Pasteur to demonstrate that these bodies were parasitic bodies, and were the sole cause of the disease, as also to prove how readily the disease can be communicated not only from silkworm to silkworm, but from one rearing-house to another situated far apart. He found that one healthy silkworm could communicate the disease to another healthy worm, and in this way: the parasites are voided by infected worms, and may be found in the frass or *dejecta*. It often happens that in crawling one over the other some worms are wounded by the legs of other worms. The three pairs of front legs in the worms, the prolegs, are furnished with sharp terminations, which permit them to hold the leaves on which they are feeding firmly, and the accidental wounds or punctures above referred to are caused by these sharp legs. If previous to puncturing in this way the skin of another the worm has smeared these prolegs by walking over *dejecta*, and if the *dejecta* came from a worm suffering from Pébrine and passing these parasites, it is evident at once that here was a means by which the disease could be propagated by one healthy worm to another healthy worm. To test this Pasteur introduced by needle puncture these parasites into a previously healthy worm, and thus infected it. The leaves, too, on which the worms fed might become soiled by frass containing these parasites, and upon this contaminated food being ingested Pébrine would ensue. This he verified by feeding healthy worms with leaves bearing parasites on their surface. The dust in rearing-houses he found contained the parasites, and this dust, settling on the leaves, readily conveyed the disease. A rearer who had never seen Pébrine universal in a rearing-house went to visit a house in which the disease was rampant. He spent some time in the infected house, and took the disease away with him in the dust which lodged on his clothes, and introduced it with

disastrous effect into his own rearing-house, in which he had hitherto only most healthy worms.

But Pasteur demonstrated not only that the disease could be transmitted from worm to worm, by one or all of these modes, but also that the disease is hereditary, and that under such circumstances it is most fatal, destroying the worms whilst yet small. An experienced eye can see at a glance whether Pébrine is abnormally prevalent in a rearing-house. It is not requisite to see the black spots on the skin of the diseased worms, but it is at once observed that, although the worms have hatched almost simultaneously, and have been reared under precisely similar conditions, there is a marked difference in the size of them. Some, the healthy worms, have progressed favourably, changing their skins regularly, and have attained nearly their full growth. Others, the diseased worms, are more or less retarded; some are very small, and seem to have made scarcely any progress, and there is every intermediate size between these and the healthy worms, according as the subject is more or less infested by the parasites. This want of uniformity of size is, as I have already remarked, very noticeable, and at once suggests the presence of Pébrine. By experiment Pasteur demonstrated, as indeed would seem but natural, that the earlier in life a worm became infected the less likelihood was there of it living to produce silk. It was whilst investigating the meaning of the wholesale destruction of young larvæ in houses which had hitherto been free of Pébrine that he was led to examine the moths and the ova laid by them. On the former he discovered the black spots and the parasites, and these latter he also found in the ova, pointing to the disease being hereditary.

Supposing worms have been healthy, and yet almost at the last period of their existence as worms they become infected in any one of the ways already noted. It is too late in life for the disease to kill them, or even to prevent them spinning their cocoons; but nevertheless they bear in them the seeds of the disease. Having spun their cocoons they in ordinary course turn to chrysalids. The newly-disclosed chrysalis contains at the very first nothing but a substance of creamy consistence, having no divisions into head, thorax, and abdomen. As these divisions and the internal economy of the perfect insect are gradually developed, certain of the parasites contained by the diseased worm are enclosed by the newly forming membranes, and in this gradual process some parasites become imprisoned by the membranes of the future ova. Thus, when the ova are laid, they contain from the very first the germs of Pébrine, and presage certain and untimely death of the larvæ issuing from them. Seeds from different parents would not all be infected, and seeds even from infected parents would not all of them enclose the

parasite; and so one might reasonably anticipate some small number at least of healthy worms would hatch from any given seed. The infected ova would produce infected worms doomed to an early death, yet not dying before they would become a source of infection to healthy worms feeding with them. Pasteur observed that a very large number of worms which had not inherited the disease but had become infected somewhat late in life, attained almost their full growth, and would mount into the twigs provided for them in which to spin their cocoons, and then, although moving their heads from side to side, and going through all the motions of spinning cocoons, they produced no silk whatever. They seemed spinning invisible cocoons with invisible silk.

Upon making a post-mortem examination of such worms it was found that the glands, which in a normal condition would have produced that wonderful fluid which as it is ejected by the worm dries and forms silk, were crammed by the Pébrine parasite, to the total exclusion of the silk secretion. On this circumstance, and the fact that the silk-glands at all times seem most infected, Pasteur founds his hypothesis that the silk-glands are the proper habitat of these parasites. He says as the habitat of the tapeworm is the large intestine, as muscle is the locality for trichina spiralis, so the glands of the silkworm are the chosen home of the Pébrine parasite.

As regards the propagation of the parasite itself, it would seem to be in this fashion. At a certain period of its existence it loses its glistening appearance. As it becomes duller small granular particles are formed in its interior; these increase in size until at last the capsule of the parent parasite separates, and allows the nuclei to escape, and these then commence an independent existence, gradually developing into the glistening full-sized parasite.

The discovery that Pébrine may become an hereditary disease not only explained the extermination which overtook some entire broods, but at the same time furnished the clue to a practical means of predicting the probable result of rearing the worms of any batch of seed. If, upon crushing a few ova and examining their fluid contents under a microscope, a very large number of parasites are discovered, it may safely be predicted that the rearing of the worms from this seed will be disastrous. And upon a more or less abundance of the parasite under such microscopical examination of the seed will depend the prediction as to the more or less success in rearing worms from such and such a stock. I may say that I had three samples of seed submitted to me for microscopical examination and opinion. Relying entirely upon Pasteur's guidance in the matter, I predicted "total failure," "almost total failure," and "fairly good results" respectively as

regards these samples, and I was greatly pleased to find my predictions borne out upon subsequently being put to the test by rearing larvæ from the seeds. The practical suggestion of Pasteur for eliminating the disease seems to be but a tedious process, as indeed *revocare gradum* usually is. It was this: Bearing in mind that the disease is hereditary, and bearing in mind the various ways by which healthy worms may become infected from the company of diseased worms, he suggests that, commencing with the seed which by microscopical examination promises the most success, each worm as it hatches should be kept apart, and each worm should during its life be kept in solitary confinement. Those which show signs of Pébrine should be promptly destroyed, and only those which ultimately furnish the finest cocoons should be kept to reproduce their species. Thus by careful selection and rigid seclusion alone can one once more obtain a healthy stock.

This, gentlemen, is a concentrated extract of Pasteur's report on the disease of silkworms. His patient investigations of the disease extended over five years, each fact discovered was assigned its proper place, and each deduction from it was made in that masterly manner which, in this as in many other matters, has made Pasteur's name a household word. Whether he investigates the deterioration in wine, the chicken cholera, hydrophobia, or Pébrine, he always combines patient investigation with acute reasoning in a manner which commands our admiration and is past all praise.

112.—Report on the Opening of a Round Barrow, and a supposed Saxon Burial, on the South Downs near Arundel, April 15th, 1893.

By E. Lovett.

(Read May 12th, 1893.)

Through the kindness of Mr. Collyer, a few members of the Croydon Microscopical and Natural History Club paid a visit to Arundel on Saturday, April 15th, 1893, for the purpose of inspecting the opening of a round barrow on the South Downs; and I have been asked to make a report upon what was found. Before, however, coming to the subject of this paper, it might be interesting to briefly allude to the principal methods of disposing of the dead in various countries, and at the different periods of man's existence.

It seems to have been a very general characteristic of man of

all races, and in all times, not only to regard death as a great and terrible mystery, but to treat the dead, at any rate their own dead, with the reverence and care which would be the natural result of the awe caused by that mystery. Therefore, we find such lasting memorials and such displays of art and science scattered over the world in connection with the dead of past ages, many of which are the only existing records of the people they represent, and from which alone we gather the scant information we possess regarding them.

Perhaps the earliest form of the disposal of the dead was by burial, which word simply means "hiding," the body being laid on the ground and covered over with stones, thus forming a sort of cairn or mound. This of course became elaborated, and it is probable that even in the age of stone this method developed into the erection of cists or rude slab-constructed stone chambers in the centre of its mound. From this cave-burials would naturally spring, and as caves were often inhabited, the custom of converting a man's house into his tomb, as practised by some races, would soon follow.

When we come to examine the customs of existing, or at any rate recent, races or tribes, we find that scaffold burial, open and covered, and from the latter house burial, to have been practised, not only by the aboriginal Australians in a very primitive manner, but by the Sioux, Chippawa, Blackfeet, Narajos, Cheyennes, and Esquimaux Indians in a large variety of ways, including the raised platform, tree-burial, raised boxes, lodges, and such-like erections.

The house naturally developed into the tomb, with its widespread diversity and artistic grandeur. This form of burial may almost be said to have reached its highest development in Etruscan and Egyptian times, the wonderful art of the former and the gigantic erections of the latter surpassing anything else before or since of their kind.

The catacombs of the early Christians were a sort of reversion to house or cave burials, whilst the method as at present adopted places the body deep in the earth, and rears the tomb or monument above it.

We will now revert briefly to mound burials, and these have been as widely distributed as, or perhaps even more so than, any other form of sepulture. North America is perhaps the country in which we find the highest development of this form of burial, and the gigantic mounds of the Mississippi Valley have yielded an enormous amount of evidence as to the earlier races of that continent. These mounds, which were so large that modern villages have in some instances been built upon them, were often erected in the rude outline of some animal form, and the investigation of them has proved conclusively that they were the

burial monuments of chiefs of a prehistoric stone-age race of Indians.

Mounds and barrows are plentiful in our own country, and we shall soon discuss the one which is the subject of our paper. It would, however, be of advantage to briefly examine a few more details as to forms and details of burials. In ordinary burials it has been an almost universal custom to place with the body not only the weapons and implements of the deceased, but also money and food to assist it on its unknown journey, and the means of making fire in order to procure light in the dark path before it. There is still a survival in a modified form of such ancient customs. Dolls have often been found in the graves of Roman children, and it is not an uncommon practice in our own day to bury with our dead some object of interest to the departed one.

The chiefs of sea-going tribes, such as the Vikings, were, as we know, buried in their canoes with all its and their equipments, a gigantic mound being erected over the whole. Canoe-burial is known not only in Scandinavia, but in America. Sometimes, again, the dead chief, clad in his best and most warlike costume, was placed upon the back of his living horse, and the mound was slowly reared until it buried the living and the dead together. The slaughter of slaves and even of the relatives and wives of dead chiefs is a practice well known, and dates from very early times. The Suttee as even now practised in India, and the horrible customs of the West Coast of Africa, are survivals of this dreadful accompaniment of burial. Of course the object of such slaughter is the belief that the spirits of those slain will accompany the spirit of the dead chief in the unknown regions beyond the grave.

The positions and conditions in which the bodies of the dead were deposited in their last resting place varied as much as did the modes of burial, if indeed not more so. In some instances the body was buried in a standing position, in others it was doubled up into a crouching position; in a few instances the body has been found lying on its face, whilst reposing on its side was much more frequent. The usual position, however, over a very wide range of time and area, is to place the body on its back. And then we come to its position in regard to the points of the compass. In very many instances little or no notice seems to have been taken respecting this, whilst in others we find savage races placing their dead in some position as regards the rising or setting sun; the Indians of Nebraska always bury with the head towards the east. Again, there are various theories as to the position of such monumental stones, as those of Stonehenge, for example; but it is very doubtful whether there be any reason for such theories, as the positions

are probably purely accidental. In some instances of mound burial the bodies have been placed in positions radiating from a common centre, and in those remarkable buildings for the dead, the Parsee Towers of Silence, the cavities for the reception of the bodies are arranged in a similar manner. These towers of silence are perhaps one of the most uncommon methods of disposing of the dead, which as soon as deposited are stripped of the flesh by vultures, whilst the bones are thrown into the central well, in which the remains of many generations of departed Parsees find a common resting place.

We may now consider the mounds or barrows of our own country, leaving out altogether those of other countries, in almost all of which they abound in plenty.

The barrows of Yorkshire and Wiltshire have perhaps been explored better than those of other places, the former by Canon Greenwell, and the latter by Sir Richard Colt Hoare. It would be to the Wiltshire series that our Arundel barrow would belong. The chief form is circular; the long barrow being very scarce, and supposed to belong purely to the stone age. They vary very much in size, from mere undulations of the ground caused by denudation or partial removal, to hills of which Silbury Hill in Wiltshire is a good example, covering five acres of ground, and being 130 ft. in height.

The variety of objects found in barrows in this country is very great, and includes, besides the human remains, food-pans and drinking-cups of earthenware, weapons of flint and bronze, ornaments and remains of clothing and fragments of the bones of animals, large nodules of flint, potsherds, &c. The bodies themselves were either inhumed, cremated, or partially cremated. In the cases of cremation the ashes were usually placed in an urn under the mound; in those of inhumation or partial cremation they were sometimes merely covered with earth, at others covered with flints and chalk first and earth on that; in others again a stone cist or coffin was constructed, and in one or two instances a split hollow tree has contained the body. The almost general presence of bones and broken pottery in the mounds is due to the fact that it was the custom to have a funeral feast at the time of burial or interment, and the drinking and other vessels were afterwards broken up and thrown on to the accumulating mound.

In the light of these briefly referred to descriptions of burials and barrows, we will now turn to that opened by our friends last month on the South Downs.

The first barrow inspected was situated about four miles to the east of Arundel, and nearly upon the ridge of the chalk downs, which in this part are covered with short grass. Its exact position was a few hundred yards down the northern slope, and not

on the summit. The barrow was circular, and as usual surrounded by a depression cansed by removal of the earth to form the central elevation. Its diameter to the outside of the depression was 57 ft., and it was about 5 ft. in height before it was opened. At the time it was erected it was doubtless higher than this, but settlement and long exposure to the denuding influence of wind, rain, &c., would much reduce its original height.

When the party arrived workmen had already removed much of the centre of the barrow, excavating a trench down to the broken chalky surface. The whole of the material was a dry crumbly black earth on the top, and below that the earth was largely mixed with small chalk rubble. About a foot or 18 in. above the undisturbed surface of the floor was a decided layer of carbonaceous matter, varying from an inch to 2 or 3 in. in thickness in places, and extending so far as we could ascertain to the boundary of the barrow. In this carbonaceous material were found a few fragments of bronze, too obscure to determine as to what they were, though they were probably ornaments; also some lumps of a greenish and imperfect glass, fused. These apparently represented glass vessels, possibly containing unguents, &c. Besides this were found small fragments of pottery of uncertain age, but very crude, and a small piece of ironstone and a second bit of the same, fused. Now, as this ironstone is not found in the immediate locality, it may probably have been placed there in conjunction with a piece of flint, as was frequently the case under such circumstances, as it was generally supposed that the departed spirit required the means of making a light to guide it on its way on the dark unknown journey before it.

After examining the excavation, we decided to drive a trench to the margin of the mound, which we did in a westerly direction. About ten feet from the centre we came upon a cinerary urn, resting upon the base of the interment, mouth upwards, and nearly filled with charcoal. This charcoal was placed in this urn after the cremation had taken place, and, in fact, was all that was left of the body over which this particular mound had been erected. The mound was made up of black earth and rubbly bits of chalk, in which we found a few fragments of bones, not human, and chipped flints, which were undoubtedly of greater age than the barrow itself, and which would have been unintentionally collected when rearing the mound. The fractured bones of animals and the little bits of pottery of varying tints and thicknesses were no doubt the remains of the funeral feast already referred to. In almost all barrows that have been explored such objects have been found, so that the custom was a very general one. The cinerary urn which we found does not at

all correspond with those usually found in round barrows of the bronze age, as it is certainly less artistic, and is devoid of the exterior incised decoration so characteristic of the pottery of the Yorkshire barrows. Although not corresponding in type, it is probably nearly of the same period, and I am inclined to fix the age of this barrow at that known as the early iron period, British; partly in consequence of the type of urn already referred to, and partly owing to the existence of glass in the barrow, which material, so far as I am aware, is first known in connection with the early iron age.

The remains of the bronze objects discovered in no way interferes with this theory, as bronze and iron objects have been frequently found together in barrows of this period; and as our finds of bronze were exceedingly fragmentary, and as bronze is less liable to corrosion than iron, it is very probable that any iron which may have been in the mound originally has quite disappeared, considering that the bronze has nearly gone too.

I would therefore designate our find as a British barrow of the early iron period, containing a cremated interment, with the usual accessories.

We then turned our attention to a burial of quite another kind. Some hundred yards or so down the northern slope of the hill was a roughly elongated mound, which might perhaps be called a long barrow, but the shape of which I venture to think was more probably accidental, or resulting from the general contour of the ground.

The discovery of a human finger-bone, scratched out by a rabbit from its burrow, led Mr. Collyer to think that a burial existed here, which in fact was the case. After removing the top turf, which represented a pretty considerable accumulation of root-fibre, we came upon a portion of a skeleton, which had evidently at some distant period been disturbed. Digging carefully down we eventually unearthed three fine skeletons *in situ*, at a depth of about four feet. These were lying at full length, almost north and south, with the head to the south. So far as we could judge, they had been placed upon their side, with the face towards the rising sun, a plan still adopted by some Indian tribes. I have said that this was not in my opinion a long barrow; had it been so the skeletons would have been in that peculiar crouching position, with the hands up to the face, characteristic of that form of barrow.

The size and appearance of the bones point to men of fine development, and a marked, but in such cases usual feature, is the splendid condition of teeth. Primitive and early civilized man had no need for vulcanite jaws, gold plates, and false enamel, because they used the teeth which nature had given

them, as can be seen by the worn-down crowns of the teeth in the gentleman's skull upon the table.

We could not trace that the bodies had been placed in any sort of coffin, cist, or cavity, but they had apparently been covered with earth at the time of burial. In one instance, however, we found several large natural flints placed over the skeleton, as was frequently done in inhumed burials of the bronze age. In this place we found no weapons, ornaments, or remains of objects buried with the dead; but we did find one fragment of Samian pottery-ware, which I venture to think established the theory that the interment was Saxon (after the first Roman period).

No doubt further investigation would have revealed further skeletons, and possibly objects of a more definite character than we had so far obtained.

As it was, we were only four hours at work on the two burials, whereas four days would not be too much to have devoted to the investigation of the round barrow alone. It must be borne in mind that, considering the great ages of such mounds and burials, the round barrow in question being most probably nearly or quite two thousand years old, and considering, too, the perishable nature of metal, bone, and wood, it is hardly surprising that the contents of the barrow should have been of so fragmentary a nature; indeed, it is a matter of congratulation that we found so much as we did in so short a time, a fact entirely due to the well thought out arrangements of Mr. Collyer.

The part of the country we visited is full of relics of a long-forgotten past, and the South Downs, on which the round barrow is situated, have all the peaceful appearance of down-land that has been such from time immemorial; and yet, judging from the occurrence of such interments as we investigated, and from the evidence that Mr. Collyer has obtained of others, I should say that this part, at any rate, of the South Downs is a perfect cemetery of inhumed and cremated bodies, not only of Romans and Saxons, but of prehistoric man of the early iron age, and most probably of the bronze and stone age also.

113.—Notes on the Development of Gerris najas.

By W. Budgen and C. H. Goodman.

(Read October 17th, 1893, by Mr. Goodman.)

On the 10th of May Mr. Budgen sent me some eggs of *Gerris najas*, and he has since given me the following information.

He had two pairs (male and female) of these insects in

captivity, and between April 17th and May 4th five batches of eggs were laid, with an average of eight in each. There was a plant of *Ranunculus aquatilis*, having only fine cut leaves, in the vessel, but the eggs were laid on pieces of wood floating on the water, in three cases on the under side, and in one on the upper side, the remaining one being doubtful. The eggs were clear and transparent when laid, but eventually became darker, the rich red eyes of the embryo being distinctly visible as they matured. They were a long oval in shape, loosely laid, but all in one direction, with their long axis parallel to the material on which they rest.

About three weeks after the eggs were laid the young larvæ began to hatch. When first hatched they swim about under the water like a *Corixa* or *Notonecta*, but instead of using only the posterior pair of legs as these insects do, they use both the middle and posterior pairs, and they seem to have no controlling power as to which side is uppermost. In the course of a few hours the insect assumes its normal position on the surface of the water. This change of position is accomplished very rapidly, and seems to be effected by the insect rising as far as possible to the surface, then by a kind of back-throw jerking its body out of the water, then righting itself and withdrawing its legs. It is interesting to note that this change cannot be accomplished if the surface of the water is at all filmy or stagnant, neither will the larva live if removed from the water.

The young larva when first hatched is of a pale yellow-brown colour, and the abdomen is much prolonged, comprising nearly one-third of the length of the whole creature; after a few hours the larva becomes darker in colour, and the abdomen contracts till it comprises scarcely one-seventh of the whole insect. As the insect grows the abdominal segments gradually extend, until in the pupa stage they amount to two-fifths, and in the perfect stage as much as one-half of the whole.

The perfect insects are very voracious, flies, spiders, &c., being all greedily sucked; they are gregarious, and the different stages may be found together. The species is ordinarily apterous, but Mr. Budgen informs me that he took one pupa with rudimentary wings; the imago which it produced was a cripple, but the membranous wings as well as the elytra were clearly defined. This is exceptional. (See Douglas & Scott, 'British Hemiptera,' Ray Society, pp. 560—561.)

I may add that I have found young larvæ at various times all through the summer, so that egg-laying continues for some time after the above dates, which no doubt are some of the earliest.

114.—Notes from the Ardennes.

By Dr. H. Franklin Parsons.

(Read October 17th, 1893.)

The following notes on a few observations made during a brief tour in the south of Belgium in the end of August and beginning of September, 1893, are submitted in the hope that they may not be without interest to members of the Croydon Microscopical and Natural History Club.

The route taken was to Namur, thence by steamer up the river Meuse to Dinant, thence by road to Rochefort and Han-sur-Lesse; by train to La Roche, and home again. The tract of country traversed is a plateau gradually rising to the south-east to a height of 1000—2000 ft., and deeply carved into valleys by the rivers which traverse it. It was formerly a vast forest, the Forest of Ardennes, which in Cæsar's time reached from the Rhine to the Rhone. At the present time, however, the woods are chiefly confined to the steep slopes of the valleys; the plateaux being under cultivation and devoid of timber, except long formal avenues of trees, like those in a box of toys, planted by the roadsides. The alluvial ground at the bottom of the valleys forms meadow land, in some places laid out as water meadows.

The Meuse from Namur to Dinant is a river about the size of the Thames at Hampton Court, flowing in a narrow valley with steep carboniferous limestone cliffs at the sides, like the Avon below Bristol. The carboniferous limestone is in thick beds, apparently with a general dip at a high angle to the north, but in some places nearly vertical, and in others much contorted. Here and there a hard bed of rock among softer strata has been left by denudation standing out as a wall in the side of the valley; a detached portion of such a wall near Dinant forms a solitary pinnacle of rock about 100 ft. high, called La Roche de Bayard. The cliffs are of the form familiar in the carboniferous limestone districts of this country, such as the Mendip Hills, the Welsh borders, and the Derbyshire and Yorkshire dales. Some of the crags are crowned with ruined fortresses, reminding one of those on the Rhine. A bed of boulder clay was observed in a road cutting on the higher ground near Dinant. The geological formation at Rochefort and Han-sur-Lesse is carboniferous limestone similar to that at Dinant; but between Dinant and Rochefort there is a tract composed of shales and sandstones resembling those of the coal-measures. Fossils were not plentiful in the carboniferous limestone, but corals were observed in a few places, and the large brachiopod shell, *Productus*, characteristic

of that formation. At La Roche the geological formation is slate; the precipitous cliffs characteristic of the limestone are absent, and the general aspect of the country is a succession of deep valleys with steep wooded sides, and occasional outcrops of slaty rock, like North Devon or Montgomeryshire.

The limestone district of Belgium, like other tracts composed of hard limestone rock, is full of caves, of which one of the most extensive and celebrated, the Grotte de Han, was visited. This cave illustrates in an interesting manner the mode of formation of limestone caverns. Natural caves, I may remind you, are of two kinds, and confined to two classes of situations, *viz.*, sea caves, formed mechanically by the force of the waves on the shore acting upon weak places in the cliffs, and limestone caves, which are produced by the solvent action of water holding carbonic acid in solution, traversing the fissures of the rock. Natural caves in inland districts are only found in limestone, though occasionally in soft sandstones there are extensive series of artificial workings made as places of abode, or for the purposes of getting stone.

At Han-sur-Lesse the river Lesse, a stream about the size of the Mole at Leatherhead, runs in a U-shaped valley, the centre of the bend being occupied by a hill rising about 300 ft. high above the valley; this hill is composed of thick bedded carboniferous limestone, dipping at an angle of about 45° to the north. The river Lesse enters a rocky opening, the Perte de la Lesse, in the side of this hill and disappears, reappearing on the other side of the hill, after a subterranean course of about a kilometre (five-eighths of a mile), measured in a straight line between the points of entrance and exit. The difference in level between the points of entrance and exit of the river, as shown by the map, is ten metres, or thirty-two feet. I was informed that experiments had been made by pouring coloured water into the river at the Perte, and that the colour was not perceived at the exit until twenty-four hours had elapsed; also that a horse and cart with the driver had been carried into the Perte during a flood, and had never reappeared. These circumstances would seem to show that the river in its underground course must traverse large cavities or reservoirs of water. The valley between the Perte and the Sortie is now devoid of any stream, though it has evidently been excavated by the river at a former period. About a quarter of a mile below the Perte is an opening, or rather a series of openings, in the rock, into which the river must once have run, judging from the remains of an old river channel leading to it, and from the water-worn condition of the rocks around the openings. This was formerly the entrance to the cave. The present entrance for visitors is on the hillside near it, but on a higher level. The passage through the cave takes

over two hours. The cavern consists of a series of galleries here and there expanding into large and lofty chambers. The first part is dry; then a series of galleries is traversed through which water runs in winter, the footpath being carried on a raised causeway. Finally, after many ups and downs, the subterranean river is reached, and the exit is made in boats at the lower opening. The roof and walls of the cavern are hung in many places with stalactites, unfortunately a good deal blackened by the smoke of the torches used for illuminating, and which has no means of escape. It is proposed to use electricity for lighting the larger halls. Many of the stalactites have the form of drapery-like folds, like the vallence of a bed; these are formed apparently where thin films of water percolate through long narrow cracks in the roof, or trickle over straight edges of rock. Some of these emit a bell-like note when struck. The floor of the cavern is covered with alluvial earth and stones, apparently brought by the river; this again above the river level is covered by a layer of stalagmite, with projecting bosses where the drip from the roof falls. These projecting stalagmites are truncated cones, or nearly cylindrical in shape, the summit being always marked by a shallow depression worn by the falling drop. Sometimes a stalactite and its corresponding stalagmite meet, forming a continuous column from floor to roof. Here and there the alluvial bed has apparently been washed out, and the undermined stalagmitic layer has broken across and fallen out of place, as shown by the oblique position of the stalagmites, the water trickling over the fractured edge forming a festoon of drapery-like folds. I could not learn that any human remains or implements were found in the Grotte de Han, or that it contained any peculiar fauna like the blind animals found in the caves of Austria and Kentucky, though beetles are said to be found in the first chamber from the entrance.

The fauna of the Ardennes until recently included such *feræ naturæ* as the wild boar and the wolf, but these I was informed were now extinct in the part which I visited. The roebuck and the eagle were said to be still met with, but I did not myself see any vertebrata not familiar at home, except a large green frog. A ring snake was discovered basking on the edge of a pond; when alarmed it plunged into the water, and swam with a wavy eel-like motion. Among insects,—of butterflies, the "pale clouded yellow," the "marbled white," and the grayling, or an allied species, were noticed; grasshoppers were abundant and very noisy; and several species of ants, including the great wood ant, were plentiful. An avenue of old lime trees at Rochefort was covered with thousands of a bright red species of bug, quaintly figured with black. Although so brightly coloured, these appeared to trust for safety to some protective resemblance,

perhaps to young red buds, or to droppings of birds feeding on red berries, for they remained motionless in great heaps until actually touched, when they hurried away rapidly in all directions, so that it was no easy matter to catch them. Mr. Murton Holmes tells me that its name is *Triecphora sanguinolenta*, the scarlet hopper. Of mollusca, *Helix pomatia* and *Cyclostoma elegans* were observed. Of the large slug, *Arion empiricorum*, in England usually jet black, all the specimens seen were of a bright orange colour.

The flora of the limestone regions about Dinant and Han-sur-Lesse is very rich, and many interesting plants were found in spite of the late period of the year, and the dryness of the season. The flora consists chiefly of plants which are also found in Britain, though some plants more or less abundant there are with us only found in a few localities, or as introduced species. The following may be mentioned:—

The white rock rose (*Helianthemum polifolium*). In Britain confined to limestone cliffs in two localities in the south-west of England.

Geranium sanguineum.

Sedum album.

Seseli libanotis. Common; though in Britain almost confined to the Gogmagog Hills, Cambridge.

Bupleurum falcatum. Common; but in Britain confined to Essex.

Sambucus ebulus (dwarf elder).

Chrysocoma linosyris (goldilocks). In Britain almost confined to the Great Orme's Head.

Campanula persicifolia and *C. patula.*

Verbascum lychnitis.

Melampyrum arvense.

Teucrium chamædrys.

Daphne mezereum.

Rumex scutatus.

Three species of Solomon's seal, *viz.*, *Polygonatum verticillatum*, *P. officinale*, and *P. multiflorum;* the latter accompanied, as in the west of England, by *Paris quadrifolia.*

Ceterach officinarum.

Polypodium robertianum.

The above species are in Britain found, for the most part, in the chalk districts of the south of England, or on carboniferous limestone rocks in the west. Hardly any of them can be considered of a northern or mountain type.

The following plants found are not natives of Britain:—

Arabis arenosa, or allied species.

Dianthus carthusianorum.

Trifolium montanum.

Lactuca perennis.

Vincetoxicum officinale. This plant belongs to the natural order Asclepiadaceæ, of which we have no British representative. It is common on the Continent in dry stony places, occurring as far north as Normandy.

Digitalis ambigua.

Stachys recta and *S. annua.*

Teucrium montanum.

Cornus mas. A species in foliage closely resembling our British cornel, but with red edible fruit like a cherry.

Melica ciliata, or allied species.

In the slate region about La Roche the flora is much less varied than that in the limestone district. This is partly due to the nature of the soil; the flora on a calcareous soil being as a general rule richer in species than that on an argillaceous or an arenaceous soil; but partly also to the system of forestry pursued. The woods here consist almost entirely of oak scrub, which is allowed to grow until the shoots are of a size for firewood, when it is cut down; the herbage and vegetable *débris* covering the ground between the tree stumps are collected together into heaps and burned, and the ashes are scattered over the ground as manure and ploughed in, after which a crop of corn is sown, which is able to ripen before the young shoots of the oak have grown up high enough to shade the ground. This process it is obvious must exterminate the rarer species of plants, except in situations too steep or rocky to be thus cultivated.

The only flowering plants observed here, and not at the places previously visited, were the bogbean (*Menyanthes trifoliata*), the baneberry (*Actæa spicata*), and a species of *Senecio* allied to, if not identical with, *S. saracenicus* of our river-banks.

Ferns and mosses were more plentiful than on the limestone, among the former being *Polypodium phegopteris* and *P. dryopteris.*

The pink crocus-like flowers, unaccompanied by leaves, of the meadow saffron (*Colchicum autumnale*) were abundant in the meadows everywhere. On the limestone the hawthorn was almost exclusively of the form *Cratægus oxyacanthoides*, with shining slightly lobed leaves, and bright scarlet haws having several stones; while at La Roche the form *Cratægus monogyna*, which is commonest in England, was alone observed.

In conclusion I may say that the beauty and varied interest of this region, its facility of access, the reasonable cost of living, and the civility of the inhabitants, render it a very pleasant resort for those who desire the more complete change which a holiday on the Continent affords, but whom time and other considerations forbid to visit remoter scenes.

115.—REPORT OF THE METEOROLOGICAL SUB-COMMITTEE FOR 1893.

PREPARED BY THE HON. SEC., FRANCIS CAMPBELL BAYARD, F. R. Met. Soc.

(Read February 20th, 1894.)

THE arrangements for observing the daily rainfall have been successfully carried out on the same plan as heretofore, and, as will be at once evident, great progress has been made. This Report contains the records of 63 stations, contributed by a staff numbering 51 observers, as against 54 records and 46 observers in the last Report.

During the course of the year two stations have disappeared, namely, Heathfield, Keston, through the removal of the observer, Miss M. Holland; and Oakfield Road, Croydon, through the removal of the observer, Mr. Malden, to Chatfield Road, Croydon. This last station, I am pleased to announce, will reappear again this year.

Appendix I. to this Report contains a list of the observers, with particulars relating to the stations and gauges. The nine stations with the asterisk prefixed were admitted after the commencement of the year, and the two with the double asterisks are stations which sent in reports in the previous year.

Appendix II. contains the tables of daily rainfall issued monthly, and subsequently stereotyped.

Appendix III. gives the monthly rainfall of 10 other stations.

Appendix IV. gives a record of all falls of rain of 1 in. and upwards in the 24 hours, extracted from Appendix II. and other sources.

And, finally, Appendix V. contains general notes on the characteristic features of every month, and with reference to them the Hon. Sec. desires to acknowledge his indebtedness to Mr. Rostron's very valuable notes, which have been published in the 'Wallington Herald.'

The Sub-Committee report with great pleasure the accession of stations at Reigate Hill, Warlingham, Epsom, Thornton Heath, Streatham Hill, Battersea Creek, Forest Hill, Nunhead, and Woolwich, all of which are very welcome, as filling up gaps in the Sub-Committee's list of stations.

With respect to the rainfall of the year, the smallness of the total fall is very remarkable. If we take the Greenwich record for 78 years (1816–93) we find that there are only 12 years in

which the annual fall was smaller than 1893, and they are as follows:—

	inches.		inches.
1837	19·11	1863	19·66
1840	16·43	1864	16·38
1847	17·61	1870	18·55
1850	19·53	1874	19·95
1854	19·01	1884	18·05
1858	17·70	1887	19·86

1893 .... 20·09 inches.

As the average yearly rainfall at Greenwich for the 50 years (1841–90) is 24·54 in., we have at once a deficiency of nearly 4½ in., a very large quantity. Going back, however, to a longer period at Greenwich, we find that the average yearly rainfall for the 75 years (1816–90) is 25·11 in., and we have therefore a deficiency of 5·02 in. This latter quantity your Sub-Committee think more nearly represents the deficiency in the Club district. If we now turn to the several months, again making use of the 75 years' average at Greenwich, and applying it to the Greenwich observations of 1893, we find that in only four months was the rainfall above the average, and as the comparison will prove interesting, the following table has been constructed:—

Greenwich.

	Average, 75 years.	1893.	Average.
January	1·90 in.	1·54 in.	—0·36 in.
February	1·61 ,,	2·62 ,,	+ 1·01 ,,
March	1·54 ,,	0·39 ,,	—1·15 ,,
April	1·70 ,,	0·12 ,,	—1·58 ,,
May	2·04 ,,	0·53 ,,	—1·51 ,,
June	2·00 ,,	0·82 ,,	—1·18 ,,
July	2·58 ,,	3·33 ,,	+ 0·75 ,,
August	2·31 ,,	1·38 ,,	—0·93 ,,
September	2·38 ,,	1·16 ,,	—1·22 ,,
October	2·75 ,,	4·16 ,,	+ 1·41 ,,
November	2·37 ,,	1·92 ,,	—0·45 ,,
December	1·93 ,,	2·12 ,,	+ 0·19 ,,
Year	25·11 in.	20·09 in.	—5·02 in.

On examining this table we cannot but be struck with the very great deficiency in the first six months, *viz.*, 4·77 in., as compared with the last six months, when the deficiency is only 0·25 in. This great deficiency in the earlier half of the year sufficiently accounts for the great losses inflicted on all connected with the land.

It is not proposed to go into the question of droughts, absolute and partial, which have already been so ably treated by our hon. member, Mr. Symons, in the 'Meteorological Magazine,' 1893, p. 97, when great use was made of the tables published by your Sub-Committee.

With reference to the water supply of the present year, the great deficiency of last year will not have much effect, for, owing to the wet October, December, and January of the present year, the underground stores of water will be well replenished.

The Sub-Committee would draw the attention of the members of the Club to the very small number of days—only three—on which 1 in. or more fell in the 24 hours, and also to the comparative smallness of the falls. This forms a very striking feature in the Sub-Committee's Report, and is in marked contrast with the reports of previous years.

In conclusion, the Sub-Committee desire to express their thanks to those gentlemen who so kindly subscribed the amount necessary to enable this great work to be carried on, and to all the observers for their hearty co-operation in so promptly forwarding their returns.

APPENDIX I.

No.	Stations.	Observers.	Size of Gauge.	Height of Gauge above Ground.		Height of Gauge above Sea-level.
			IN.	FT.	IN.	FT.
	Surrey—Dorking (Denbies)	J. Beesley	5	0	6	610
	*Reigate Hill (Margery Hall)	W. F. Taylor	5	2	0	756
	Caterham (Metropolitan Asylum) ..	G. S. Elliott, M.D.	5	1	0	610
	Caterham Val. (Congregational Col.)	Miss S. W. Rudd.......	5	1	0	500
5	Marden Park (Birchwood House) ..	Mrs. Frank Rutley	5	1	0	471
	Kent—Westerham (The Fishponds) ..	W. Morris, C.E.	5	1	0	380
	**Knockholt (The Beeches)	W. Morris, C.E.	5	1	0	785
	Surrey—*Warlingham (The Vicarage)	Rev. F. R. Marriott....	5	1	0	614
	Coulsdon (The Grange)	W. J. Stride	5	1	4	525
10	Kenley (Ingleside)	Harold Smith	8	1	0	375
	Purley (Reedham Asylum)	J. A. Carter	5	1	0	375
	Purley (Tudor Cottages)	J. Bonwick	5	1	0	216
	Ashtead (D'Abernon Chase)	Sir W. Vincent, Bt.	5	1	0	280
	Oxshott	W. H. Dines	5	1	0	212
15	*Epsom (Epsom College)	C. J. Gardiner	8	1	0	290
	Banstead (The Larches)	Rev. C. J. Taylor......	8	1	0	488
	Sutton (Mulgrave Road)	W. Goode	5	5	6	230
	Wallington (Manor Road)	F. Campbell Bayard ..	5	4	1	157
	Beddington (Riverside)	S. Rostron	5	1	0	120
20	Waddon (Waddon House)	P. Crowley	5	1	0	156
	Croydon (Brimstone Barn)	Croydon Corporation ..	5	1	0	130
	**Croydon (Waddon New Road)	Croydon Corporation ..	5	1	0	146
	Croydon (Duppas House)	Baldwin Latham, C.E..	8	1	0	158
	Croydon (Whitgift School)........	A. E. Watson	5	1	0	191
25	Croydon (Park Hill Rise)	H. F. Parsons, M.D. ..	5	1	0	250
	Croydon (Outram Road)	E. Mawley	8	0	9	202
	Addington Hills (The Reservoir) ..	Croydon Corporation ..	8	0	9	473
	Addington (Park Farm)	W. Whalley	5	1	0	268
	Addington (Pumping Station)	Croydon Corporation ..	8	1	0	331
30	Kent—West Wickham (Layham's Fm.)	W. Ashcroft	5	1	0	500
	Hayes Common (The Warren)	Miss Akers	5	1	0	296
	Keston (Bradfield)	A. Hill	5	1	0	350
	Keston (Heathfield)	Miss M. Holland	5	0	6	420
	Keston (Tower Fields)	G. Buchanan, C.E.	8	0	9	351
35	Orpington (Kent Waterworks)	W. Morris, C.E.	5	1	0	220
	Farningham Hill	A. J. Waring	5	3	0	300
	Wilmington (Kent Waterworks) ..	W. Morris, C.E.	5	1	0	25
	Bickley (Highfield)	J. Batten	5	1	2	295
	Bromley (Sundridge Avenue)......	J. B. Snell	5	1	0	245
40	Beckenham (Foxgrove)	P. Bicknell	5	0	6	142
	Surrey—South Norwood (Selhurst Rd.)	B. N. Dalton, M.D.....	5	1	0	210
	*Thornton Heath (Thornton Road)..	A. Wright	8	0	10	120
	*Streatham Hill (Wavertree Road)..	F. Jordan	5	0	10	178
	Wimbledon (Sewage Works)	C. H. Cooper, C.E.	5	1	0	58
45	Wimbledon (Mount Ararat)	T. Devas	12	3	0	157
	Raynes Park (Pumping Station) ..	C. H. Cooper, C.E.	5	1	0	47
	New Malden (Sewage Works)......	T. V. H. Davison, C.E.	5	1	0	45
	Esher (Sewage Works)............	Baldwin Latham, C.E. .	5	1	0	40
	Surbiton (Seething Wells)	R. Hack, C.E.	10	0	6	25
50	Kingston (Sewage Works)	T. Stevens............	5	1	0	25
	Richmond (Ormond Lodge)........	J. T. Billett	5	0	9	51
	*Battersea Creek (S. & V. Water Co.)	J. W. Restler, C.E.	5	3	0	21
	Brixton (Acre Lane)..............	F. Gaster	8	1	0	77
	Wandsworth Common (Patten Rd.).	F. J. Brodie	5	1	0	100
55	West Norwood (Thornlaw Road) ..	W. Marriott	8	1	0	220
	Kent—Forest Hill (Dartmouth Road)	Mrs. Behrens	5	1	0	220
	Forest Hill (The Nurseries)........	James Carter & Co.....	6	0	6	76
	*Forest Hill (S. & V. Water Co.) ..	J. W. Restler, C.E.	5	1	0	344
	*Nunhead (S & V. Water Co.)	J. W. Restler, C.E.	5	4	0	176
60	Deptford (Kent Waterworks)	W. Morris, C.E.	5	1	0	20
	Greenwich (Royal Observatory)	The Astronomer Royal .	8	0	5	155
	*Woolwich (Powis Street)..........	J. G. Waller	5	30	0	65
	Eltham (High Street)	W. Morris, C.E.	5	1	0	245

Daily Rainfall. *The 50 years (1841–90) mean at Greenwich for January is 1·99 in.* **January, 1893.**

Day of Mo.	Dorking	Caterham	Caterham Valley	Marden Park	Westerham	Coulsdon	Kenley	Purley (Reedham)	Purley (Tudor C.)	Ashtead	Oxshott	Banstead	Sutton	Wallington	Bedding-ton	Waddon	Croydon (Brim. Bn.)	Croydon Duppas H.	Croydon (Whitgift)	Croydon (Park Hill)	Croydon (Outm.Rd.)	Addington Hills	Addington (Park Fm.)	Addington (Pump.St.)	West Wickham	Hayes Common
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	..	..	·01	..	..	·05	..	..	·01	·04	·05	·02	·02	·01	..	·06	·07	·08	·01	·06	·02	..	..	..	·01
2	..	..	..	..	..	..	..	..	..	·02	..	..	..	..	..	..	..	..	·03	..	..	..	..	..	..	..
3	·14	..	..	·02	..	..	·04	·02	..	·10	·09	·10	·01	..	..	..	·03	·03	·02	·04	·03	·05	·03	·03	·02	·03
4	..	..	..	..	..	..	..	..	..	·03	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
5	·04	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
6	..	..	..	·05	..	..	·05	·06	..	·02	·01	·04	·01	·05	·04	·03	·05	·04	..	·05	·04	·04	..	·04	·06	·06
7	..	..	..	..	..	..	·01	..	..	..	..	..	·01	·01	..	..	..	..	·03	..	·01	..	..	·04	..	..
8	·18	·24	·21	·21	·17	·27	·22	·20	·29	·09	·16	·18	·19	·22	·11	·19	·12	·20	·21	·21	·20	·17	·20	·21	·17	·23
9	·36	·34	·32	·34	·27	·32	·32	·34	·34	·38	·32	·33	·36	·36	·35	·33	·03	·34	·36	·36	·35	·36	·37	·33	·36	·34
10	..	..	..	..	..	..	..	..	·05	..	..	·03	..	..	..	..	..	..	..	..	..	..	..	..	·02	..
11	..	·11	·29	·05	·04	..	·04	..	..	·03	·03	..	·04	·03	·02	·02	..	·02	·01	·02	·02	·03	·05	·05	·05	·06
12	·15	·02	..	·02	·01	..	·02	..	..	·03	·02	..	·03	·03	·01	·02	·06	·02	·03	·02	·03	·03	·04	·04	·04	·04
13	..	..	..	..	..	·08	..	..	..	·04	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	·01	..
14	..	..	..	..	..	..	·01	..	..	·01	·01	..	..	..	..	..	..	..	·01	..	..	..	..	..	..	..
15	..	..	..	·01	..	..	·01	..	..	..	..	..	..	..	·01	..	..	·01	·01	..	..	·01	..	..	..	·02
16	·45	·61	·43	·39	·31	..	·32	·38	·30	·29	·24	·35	·28	·26	·24	·25	·24	·26	·27	·23	·27	·24	·32	·32	·36	·28
17	·23	·16	·13	·17	·13	·52	·14	·18	·13	·18	·17	·19	·16	·13	·15	·11	·10	·13	·13	·12	·14	·15	·05	·13	·21	·15
18	·06	·06	·15	·08	·07	..	·10	·02	·08	·03	·02	·03	·05	·05	·03	·08	·09	·06	·06	·06	·05	·08	·13	·10	..	·08
19	..	..	..	·01	..	..	·01	..	·05	·01	..	..	·02	·01	·01	..	..	..	..	..	·01	·01	·01	·01	..	·01
20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
21	..	..	..	·02	..	..	·06	..	·11	·03	..	..	·05	·05	·15	·05	..	·06	·02	·05	·05	·06	·05	·03	·05	·04
22	·03	·10	·06	·04	·06	·09	·03	·09	..	·01	·03	·10	·08	·05	·03	·03	·09	·02	·05	·02	·01	·02	·01	·03	..	·01
23	..	..	·05	·01	·06	..	..	·01	·03	..	·01	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..
24	..	..	..	..	..	..	..	..	·02	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
25	·02	·03	..	·01	..	..	·02	..	·03	..	..	..	..	..	..	..	..	·01	·01	..	·01	·01	..	..	..	..
26	·21	·25	·25	·20	·85	·24	·20	·18	·14	·12	·11	·22	·14	·15	·14	·14	·12	·15	·16	·15	·19	·15	·07	·17	·17	·14
27	..	..	..	..	..	..	..	..	·01	·01	..	..	..	..	..	..	..	·01	·01	..	·01	..	·01	·02	..	·01
28	·23	·39	·15	·13	·13	·14	·21	·12	·02	·18	·13	·23	·21	·20	·19	·15	·16	·17	·13	·16	·17	·16	·15	·12	·13	·14
29	·05	·03	·04	·02	..	·02	·04	·05	·11	·02	·02	·02	·02	·01	·01	·01	·02	·01	·05	·01	·01	·03	·02	·03	·03	·01
30	·22	·23	·21	·20	·12	·15	·17	·11	·13	·09	·08	·13	·07	·07	·06	·03	·05	·07	·07	·07	·08	·08	·13	·12	·13	·09
31	·13	·19	·20	·19	·27	·14	·14	·12	·14	·11	·10	..	·12	·12	·11	·10	·10	·12	·11	·11	·11	·12	·14	·14	·16	·14
*	2·50	2·76	2·49	2·19	2·49	1·97	2·21	1·88	1·98	1·85	1·59	2·00	1·87	1·83	1·68	1·54	1·32	1·80	1·86	1·69	1·85	1·82	1·78	1·96	1·97	1·89
†	2·50	2·76	2·49	2·19	2·49	1·97	2·21	1·88	1·98	1·85	1·59	2·00	1·87	1·83	1·68	1·54	1·32	1·80	1·86	1·69	1·85	1·82	1·78	1·96	1·97	1·89

* The figures in this row give the totals for the month. † The totals from January 1st.

Daily Rainfall. *The 50 years (1841–90) mean at Greenwich for January is 1·99 in.* **January, 1893.**

Day of Mo.	Keston (Bradfield)	Keston (Heathfld.)	Keston (Tow. Fds.)	Orpington	Farning-ham Hill	Wilming-ton	Bickley	Bromley	Beckenham	South Norwood	Wimbledon (Sew. Wks.)	Wimbledon (Mt. Ararat)	Raynes Park
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	·07	·01	..	·03	..	..	·11	·01	·01	·03	..	·02
2	·01	..	..	..	..	·01	·03	..	..	·02	..	..	·02
3	·02	..	·03	..	·01	·02	..	..	·01	·01	·02	·02	·03
4	..	..	..	..	..	..	..	..	..	..	..	..	..
5	..	..	..	..	..	..	..	..	..	..	..	..	..
6	·05	·02	·08	..	·05	·05	·06	·05	·05	..	·04	..	·03
7	·01	·03	..	..	..	..	..	..	..	·02	..	..	..
8	·23	·22	·22	·26	·17	·25	·23	·22	·17	·22	·16	·24	·16
9	·35	·33	·34	·32	·30	·23	·34	·33	·30	·36	·32	·36	·34
10	..	..	·02	·03	·01	·02	..	..	..	..	..	..	·02
11	·06	·07	·04	·03	·02	·01	·05	·05	·02	·02	·05	·03	·04
12	·05	·03	·04	·01	·02	..	·04	·03	·04	·03	·02	·02	·03
13	·01	·03	·01	..	·01	..	·02	·01	..	..	..	..	..
14	..	..	..	..	..	..	..	..	·01	..	·01	..	·02
15	·01	..	..	..	..	..	·02	·01	..	..	·01	..	·02
16	·29	·35	·32	·33	·30	·22	·28	·28	·23	·26	·20	·25	·24
17	·11	·13	·20	·13	·12	·13	·12	·12	·12	·17	·16	·22	·15
18	·11	·09	·09	·12	·06	·05	·08	·10	·06	·03	·04	·02	·06
19	·01	·02	·02	..	..	..	..	..	..	..	·01	..	·02
20	..	..	..	..	..	..	..	..	..	..	..	..	..
21	..	·01	·03	·03	·06	·09	·05	·04	·03	·01	·04	·02	·05
22	·04	..	..	·02	·02	·02	·02	·01	·01	·01	·07	·14	·10
23	..	..	·01	·02	..	..	..	·01	..	..	..	..	·01
24	..	·02	..	..	..	..	..	..	..	..	..	..	..
25	..	..	..	..	..	..	..	·01	·01	..	..	..	·01
26	·17	·19	·18	·15	·16	·10	·11	·12	·12	·13	·16	·15	·16
27	..	..	..	..	..	..	·01	·01	·01	..	·01	..	..
28	·13	·16	·15	·13	·11	·03	·12	·11	·11	·14	·08	·09	·11
29	·02	·04	·03	·01	·02	..	·03	·02	·01	·01	..	..	·02
30	·10	·15	·12	·12	·11	·03	·05	·05	·03	·05	·04	·05	·06
31	·12	·15	·14	·13	·13	·14	·15	·14	·11	·11	·10	·12	·12
*	1·90	2·11	2·08	1·84	1·71	1·40	1·81	1·83	1·46	1·61	1·57	1·73	1·84
†	1·90	2·11	2·08	1·84	1·71	1·40	1·81	1·83	1·46	1·61	1·57	1·73	1·84

Day of Mo.	New Malden	Esher	Surbiton	Kingston	Richmond	Brixton	Wandswth. Common	West Norwood	Forest Hill Dartmh.rd.	Forest Hill (Nurseries)	Deptford	Greenwich	Eltham
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·04	·04	·01	·05	·02	·01	·01	·01	..	..	..	..	..
2	..	·01	..	·01	·01	..	..	..	..	..	..	·01	..
3	·02	·03	·02	..	..	·02	·02	·02	..	..	..	..	..
4	..	..	..	..	..	..	..	..	..	..	..	..	..
5	..	..	..	..	..	..	..	..	..	..	..	..	..
6	..	..	..	·01	·02	·02	·02	·05	·06	..	·04	·05	..
7	·02	·01	..	·15	..	..	..	..	..	..	..	..	..
8	·13	·14	·17	·04	·16	·12	·18	·20	·19	·26	·18	·17	·31
9	·29	·29	·30	·35	·30	·34	·27	·33	·32	·38	·31	·32	·31
10	..	..	..	..	..	·01	..	..	..	..	·01	..	..
11	·03	·03	..	·02	·03	·02	·05	·02	·01	·02	..	·01	·03
12	..	·01	..	·04	·03	·02	·03	·03	·04	·06	·05	·05	·03
13	..	..	..	..	..	·01	..	..	·01	·02	..	..	·01
14	..	..	..	..	..	..	..	..	·02	..	..	..	..
15	..	..	..	..	..	..	..	..	..	..	..	..	..
16	·19	·22	·25	·22	·23	·25	·23	·26	·23	·31	·25	·25	·29
17	·17	·17	·15	·19	·17	·10	·12	·14	·13	·05	·11	·13	·10
18	..	·01	·01	·01	·02	·08	·07	·06	·11	·17	·06	·07	·12
19	·02	·03	..	..	..	..	..	·01	..	..	..	..	..
20	..	..	..	..	..	..	..	..	..	..	..	..	..
21	·06	..	..	..	·03	·05	·07	·06	·05	·04	·02	·03	·02
22	..	·02	·04	·05	·05	·02	·04	·02	..	·01	..	..	·03
23	..	..	..	..	..	..	..	..	·01	..	..	..	·01
24	..	..	..	..	..	..	..	..	..	..	..	..	..
25	..	..	..	..	·01	..	..	..	..	..	..	..	..
26	·12	·14	·13	·17	·16	·18	·18	·16	·16	·12	·15	·16	·12
27	..	..	..	..	..	..	..	..	·01	·02	..	·01	..
28	·06	·07	·07	·01	·08	·08	·09	·14	·10	·13	·04	·10	·09
29	..	·02	..	..	·01	·01	·02	·01	·02	·02	·01	·01	·02
30	·03	·05	·01	·04	·05	·05	·04	·05	·03	·03	·03	·03	·03
31	·09	·13	·13	·13	·14	·13	·13	·14	·10	·17	·13	·14	·14
*	1·27	1·42	1·29	1·49	1·52	1·52	1·57	1·71	1·60	1·81	1·39	1·54	1·66
†	1·27	1·42	1·29	1·49	1·52	1·52	1·57	1·71	1·60	1·81	1·39	1·54	1·66

* The figures in this row give the totals for the month. † The totals from January 1st.

Daily Rainfall. *The 50 years (1841–90) mean at Greenwich for February is 1·48 in.* **February, 1893.**

Day of Mo.	Dorking	Caterham	Caterham Valley	Marden Park	Westerham	Coulsdon	Kenley	Purley (Reedham)	Purley (Tudor C.)	Ashtead	Oxshott	Banstead	Sutton
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·22	·11	·11	·09	·12	·10	·09	·10	·10	·09	·10	·21	·10
2	·23	·23	·23	·17	·13	·21	·18	·18	·19	·17	·18	·20	·17
3	..	·01	..	·01	·15	·02	·02	·01	..	..	..	..	·02
4	..	..	..	..	..	..	..	..	..	..	..	..	..
5	..	..	..	..	..	..	..	..	..	..	..	..	..
6	·08	·07	·09	·05	·07	·04	·06	·05	·07	·04	·05	·05	·04
7	·12	·06	·07	·03	..	·05	·07	·05	·08	·05	·04	·04	·07
8	..	..	..	..	·09	..	·01	..	·01	..	..	..	..
9	·17	·19	·22	·13	·31	·17	·19	·17	·17	·13	·11	·16	·16
10	·02	·03	·05	·06	·05	·03	·03	·03	·07	·02	·01	·02	·03
11	·13	·06	·09	·03	·20	·06	·06	·05	..	·08	·05	·06	·08
12	·03	·03	·05	·02	..	·02	·02	·02	·02	·02	·02	..	·02
13	·14	·13	·14	·09	·13	·09	·12	·08	·09	·09	·07	·12	·08
14	·20	·29	·22	·18	·10	·17	·29	·21	·22	·17	·14	·20	·19
15	·02	·05	·05	·04	..	·03	·03	·02	·02	·01	·02	·01	·02
16	·15	·13	·12	·06	·15	·06	·05	·04	·05	·05	·04	·09	·06
17	·05	·08	·07	·11	·05	·05	·05	·03	..	·04	·04	·05	·05
18	·34	·34	·28	·33	·30	·27	·26	·23	·25	·20	·20	·27	·23
19	·02	·02	..	..	..	·01	..	..	·04	..	..	..	..
20	·41	·45	·37	·30	·36	·31	·41	·36	·31	·30	·25	·46	·36
21	·37	·54	·56	·47	·68	·46	·38	·37	·37	·31	·23	·39	·36
22	·32	·32	·33	·26	·40	·31	·30	·34	·35	·20	·27	·32	·29
23	..	·03	..	·10	..	..	..	·01	·02	·01	..	..	..
24	..	..	..	..	..	..	..	..	..	..	..	..	..
25	·38	·25	·21	·41	·30	·29	·42	·35	·39	·38	·36	·27	·40
26	·40	·25	·17	·09	·25	·17	·27	·23	·31	·45	·38	·46	·57
27	·30	·40	·31	·37	·24	·27	·24	·27	·29	·28	·30	·28	·25
28	·22	·12	·14	·20	..	·41	·06	·09	·14	·12	·15	·11	·15
*	4·32	4·19	3·88	3·60	4·08	3·60	3·61	3·29	3·56	3·21	3·01	3·77	3·60
†	6·82	6·95	6·37	5·79	6·57	5·57	5·82	5·17	5·54	5·06	4·60	5·77	5·47

Day of Mo.	Wallington	Bedding-ton	Waddon	Croydon (Brim. Bn.)	Croydon Duppas H.	Croydon (Whitgift)	Croydon (Park Hill)	Croydon (Outm.Rd.)	Addington Hills	Addington (Park Fm.)	Addington (Pump.St.)	West Wickham	Hayes Common
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·09	·09	·09	·10	·09	·09	·08	·08	·09	·10	·09	·08	·09
2	·16	·15	·15	·16	·16	·16	·17	·16	·17	·18	·17	·20	·18
3	..	..	..	·01	·01	..	·01	·01	..	..	..	..	·01
4	..	..	..	..	..	..	..	..	..	..	..	..	..
5	..	..	..	..	..	..	..	..	..	..	..	..	..
6	·03	·03	·03	·05	·04	·04	·04	·04	·04	..	·04	·05	·04
7	·05	·05	·05	·08	·06	·08	·07	·08	·06	·11	·06	·06	·07
8	..	..	..	..	·01	..	..	..	..	..	..	..	..
9	·15	·17	·15	·11	·15	·13	·11	·12	·15	·16	·14	·13	·12
10	·03	·03	·04	·04	·03	·06	·04	·03	·04	·05	·04	·04	·04
11	·08	·08	·08	·08	·08	·08	·08	·07	·07	·07	·05	·05	·06
12	·01	·01	·01	·02	·01	·01	..	·01	..	·01	·01	·01	·01
13	·08	·08	·07	·06	·08	·08	·08	·08	·08	·10	·10	·08	·07
14	·21	·20	·18	·15	·18	·24	·23	·24	·17	·23	·25	·23	·19
15	·01	·02	·02	..	·01	·03	·01	·01	·02	·02	·02	·02	·03
16	·07	·05	·05	·04	·06	·07	·04	·04	·04	·05	·07	·11	·06
17	·03	·02	·01	·02	·02	·03	·01	·02	·02	·02	·03	·02	·02
18	·19	·19	·16	·12	·19	·21	·18	·18	·20	·23	·23	·25	·19
19	..	..	..	..	..	..	..	..	..	..	..	..	..
20	·33	·30	·25	·19	·28	·30	·23	·23	·30	·34	·42	·32	·34
21	·38	·39	·35	·34	·35	·40	·43	·44	·48	·51	·57	·79	·53
22	·32	·33	·30	·34	·33	·37	·37	·34	·33	·44	·42	·31	·03
23	·01	..	..	..	..	..	..	..	..	·02	·01	·03	·02
24	..	..	..	..	..	..	..	..	..	..	..	..	..
25	·29	·29	·38	·36	·34	·50	·35	·37	·31	·29	·31	·28	·33
26	·49	·45	·26	·36	·45	·37	·44	·36	·41	·48	·34	·34	·43
27	·26	·27	·25	·24	·27	·35	·31	·29	·28	·27	·27	·36	·28
28	·10	·12	·10	·09	·13	·12	·10	·16	·10	·07	·06	·01	·09
*	3·37	3·32	2·98	2·96	3·33	3·72	3·38	3·36	3·36	3·75	3·70	3·77	3·23
†	5·20	5·00	4·52	4·28	5·13	5·58	5·07	5·21	5·18	5·53	5·66	5·74	5·12

* The figures in this row give the totals for the month. † The totals from January 1st.

Daily Rainfall. *The 50 years (1841–90) mean at Greenwich for February is 1·48 in.* **February, 1893.**

Day of Mo.	Keston (Bradfield)	Keston (Heathfd.)	Keston (Tow. Fds.)	Orpington	Farning-ham Hill	Wilming-ton	Bickley	Bromley	Beckenham	South Norwood	Wimbledon (Sew. Wks.)	Wimbledon (Mt. Ararat)	Raynes Park	New Malden	Esher	Surbiton	Kingston	Richmond	Brixton	Wandswth. Common	West Norwood	Forest Hill Dartmh. rd.	Forest Hill (Nurseries)	Deptford	Greenwich	Eltham
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·07	·08	·08	·07	..	·11	·12	·09	·10	·11	·14	·13	·13	·08	·09	·06	·10	·12	·10	·13	·12	·12	·11	·11	·13	·09
2	·18	·18	·17	·14	..	·09	·19	·18	·16	·17	·19	·15	·14	·12	·12	·10	·14	·14	·24	·17	·17	·17	·20	·12	·12	·19
3	·01	·02	·01	..	..	..	·07	·06	·01	..	..	..	·01	..	..	..	..	..	..	..	..	..	·02	·01	·01	·01
4	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
6	·04	·04	·04	·03	·03	·03	·06	·05	·03	·02	·04	·04	·04	·02	..	·02	·03	·03	·04	..	·04	·04	·06	·03	·03	·04
7	·04	·06	·07	·05	·07	·04	·07	·07	·06	·06	·03	·04	·07	·04	·07	·03	·06	·03	·01	·09	·04	·06	·07	..	·01	..
8	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..
9	·13	·18	·13	·15	·12	·14	·12	·12	·13	·11	·13	·12	·14	·07	·13	·10	·12	·14	·16	·13	·14	·15	·12	·11	·12	·14
10	·03	·04	·03	·05	·04	·05	·05	·04	·03	·05	·04	·03	·05	·02	·03	..	·02	·04	·03	·05	·05	·05	·04	·03	·03	·04
11	·05	·07	·06	..	·03	·02	·08	·08	·07	·07	·11	..	·10	·06	..	·09	·09	·08	·07	·07	·09	·11	·12	·05	·07	·09
12	·02	·02	·02	·01	·06	·02	·03	·02	·02	..	·02	..	·04	..	·02	..	·01	·02	·04	·03	·03	..	·02	·05	·04	·04
13	·05	·09	·08	·06	·05	·02	·07	·08	·06	·06	·04	·05	·05	·02	·02	·04	·05	·04	·10	·06	·04	·05	·05	·04	·05	·05
14	·15	·22	·21	·16	·12	·10	·15	·22	·15	·18	·07	·09	·13	·08	·10	·10	·05	·08	·04	·04	·15	·15	·17	·11	·11	·13
15	·02	·03	·02	·04	·02	·01	·02	·01	·01	·02	·01	·01	·02	·02	·03	·02	·02	·04	·01	·02	·01	·02	·02	·02	·02	·01
16	·07	·09	·09	·11	·07	·10	·05	·05	·03	·04	·02	·04	·04	·03	·04	·02	·04	·05	·02	·03	·03	·04	·04	·03	·03	·02
17	·02	·03	·02	·01	·01	·01	..	·02	·01	·02	·03	..	·03	·03	·04	·04	·03	·04	·02	·03	·02	·02	·01	·02	·02	·01
18	·19	·23	·21	·19	·15	·16	·20	·20	·17	·15	·14	·14	·17	·09	·17	·16	·14	·12	·14	·14	·17	·17	·20	·13	·11	·14
19	..	..	..	..	..	..	..	..	..	..	..	..	·01	·02	·02	..	..	·01	..	·01	..	..	..	..	..	..
20	·28	·34	·32	·35	·27	·18	·25	·20	·17	·26	·23	·22	·24	·17	·14	·20	·22	·17	·23	·25	·28	·30	·28	·27	·30	·15
21	·54	·53	·55	·55	·45	·22	·48	·46	·54	·52	·33	·41	·40	·21	·17	·15	·23	·25	·39	·34	·52	·39	·55	·43	·41	·40
22	·42	·37	·40	·45	·47	·30	·40	·40	·30	·32	·25	·30	·29	·21	·16	·22	·22	·16	·24	·20	·28	·27	·37	·22	·19	·26
23	·01	·04	..	·01	..	..	·04	·01	..	..	·01	..	·01	..	·02	..	..	..	..	·01	..	..	·02	..	..	..
24	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
25	·52	·32	·27	·23	·22	·20	·25	·20	·22	·43	·21	·35	·28	·15	·34	·29	·64	·33	·14	·33	·20	·20	·21	·19	·28	·21
26	·26	·38	·47	·50	·47	·29	·45	·43	·42	·35	·35	·27	·37	·35	·33	·26	·03	·21	·33	·19	·32	·32	·42	·22	·20	·32
27	·30	·31	·29	·31	·28	·30	·30	·31	·25	·23	·38	·43	·35	·35	·23	·31	·38	·42	·37	·42	·26	·28	·28	·31	·30	·27
28	·07	·11	·10	·02	·04	·03	·08	·05	·05	·18	·07	·04	·08	·07	·14	·11	·15	·13	·02	·05	·06	·04	·03	·02	·04	·03
*	3·47	3·78	3·64	3·49	2·97	2·42	3·53	3·35	2·99	3·35	2·84	2·86	3·20	2·21	2·41	2·32	2·77	2·65	2·74	2·79	3·02	2·95	3·41	2·52	2·62	2·64
†	5·37	5·89	5·72	5·33	4·68	3·82	5·34	5·18	4·45	4·96	4·41	4·59	5·04	3·48	3·83	3·61	4·26	4·17	4·26	4·36	4·73	4·55	5·22	3·91	4·16	4·30

* The figures in this row give the totals for the month. † The totals from January 1st.

Daily Rainfall. *The 50 years (1841–90) mean at Greenwich for March is 1·46 in.* **March, 1893.**

Day of Mo.	Dorking	Caterham	Caterham Valley	Marden Park	Westerham	Coulsdon	Kenley	Purley (Reedham)	Purley (Tudor C.)	Ashtead	Oxshott	Banstead	Sutton	Wallington	Bedding-ton	Waddon	Croydon (Brim. Bn.)	Croydon Duppas H.	Croydon (Whitgift)	Croydon (Park Hill)	Croydon (Outn. Rd.)	Addington Hills	Addington (Park Fm.)	Addington (Pump. St.)	West Wickham	Hayes Common
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·33	·69	·39	·52	·74	·49	·46	·36	·36	·48	·25	·32	·17	·22	·21	·20	·15	·20	·23	·24	·16	·25	·33	·37	·47	·22
2	·02	·03	..	·04	..	·03	·04	·04	·05	·01	..	..	·04	·04	·05	·05	·04	·05	·05	·06	·06	·06	·06	·05	·05	·04
3	·06	·11	·11	·06	·10	·07	·10	·09	·10	·04	·02	·08	·07	·07	·06	·06	·06	·08	·08	·08	·08	·09	·09	·07	·07	·05
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13	·11	..	·09	·05	..	·06	·07	·06	·05	·03	·02	·05	·02	·02	·03	·03	·02	·04	·02	·03	·04	·06	·08	·08	·06	·04
14	·03	..	·05	·03	·02	·02	·02	·01	·02	·03	·02	·01	·02	·02	·01	·01	·01	·02	..	·01	·02	·02	·02	·02	..	·01
15	·05	..	·07	·03	·01	·02	·02	·02	·02	·01	..	..	·05	·03	·03	·03	·04	·03	·02	·03	·03	..	·01	·01	..	..
16	·05	·12	·04	..	..	·05	·04	·04	·04	·04	·02	·03	·04	·07	·07	·05	·06	·06	·08	·06	·05	·09	·08	·04	·04	·06
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31	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
*	·65	·95	·75	·73	·87	·74	·78	·62	·65	·64	·33	·49	·41	·48	·46	·45	·38	·52	·49	·51	·46	·57	·67	·64	·69	·43
†	7·47	7·90	7·12	6·52	7·44	5·96	6·60	5·79	6·19	5·70	4·93	6·26	5·88	5·68	5·46	4·97	4·66	5·65	6·07	5·58	5·67	5·75	6·20	6·30	6·43	5·55

* The figures in this row give the totals for the month. † The totals from January 1st.

Daily Rainfall. *The 50 years (1841–90) mean at Greenwich for March is 1·46 in.* **March, 1893.**

Day of Mo.	Keston (Bradfield)	Keston (Heathfld.)	Keston (Tow. Fds.)	Orpington	Farningham Hill	Wilmington	Bickley	Bromley	Beckenham	South Norwood	Wimbledon (Sew. Wks.)	Wimbledon (Mt. Ararat)	Raynes Park	New Malden	Esher	Surbiton	Kingston	Richmond	Brixton	Wandswth. Common	West Norwood	Forest Hill Dartmh. rd.	Forest Hill (Nurseries)	Deptford	Greenwich	Eltham
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·30	RECORD CEASED.	·30	·35	·34	·17	·19	·20	·17	·08	·15	·21	·21	·15	·16	·13	·13	·08	·18	·17	·16	·16	·17	·15	·13	·16
2	·05		·06	·05	·02	·01	·05	·06	·06	·06	·05	·05	·06	·02	..	..	·02	·04	·06	·06	·06	·07	·06	·04	·04	·03
3	·06		·05	·04	·04	·02	·06	·06	·07	..	·04	·03	·04	·01	·06	·01	·02	·04	·05	·05	·07	·03	·09	·07	·08	·08
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14	·02		·01	·01	·01	..	·02	..	..	·01	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..
15	·01		·01	..	..	·01	·01	·04	·03	·02	·01	·01	·03	·01	·02	·01	·01	·01	·01	·02	·02	·02	·03	..	·01	..
16	·06		·12	·07	·04	·04	·07	·06	·04	·05	·03	..	·05	·03	·04	·02	·01	·03	·05	·04	·02	·05	..	·07	·07	·05
17	..		..	..	·02	·01	·02	·01	..	..	..	..	·01	·03	..	..	..	..	..	·01	..	..	..	·02	·02	·02
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*	·55		·60	·56	·54	·30	·48	·48	·40	·25	·35	·34	·47	·27	·32	·17	·21	·23	·39	·41	·35	·36	·37	·38	·39	·35
†	5·92		6·32	5·89	5·22	4·12	5·82	5·66	4·85	5·21	4·76	4·93	5·51	3·75	4·15	3·78	4·47	4·40	4·65	4·77	5·08	4·91	5·59	4·29	4·55	4·65

* The figures in this row give the totals for the month. † The totals from January 1st.

Daily Rainfall. *The 50 years (1841–90) mean at Greenwich for April is 1·66 in.* **April, 1893.**

Day of Mo.	Dorking	Caterham	Caterham Valley	Marden Park	Westerham	Coulsdon	Kenley	Purley (Reedham)	Purley (Tudor C.)	Ashtead	Oxshott	Banstead	Sutton	Wallington	Bedding-ton	Waddon	Croydon (Brim. Bn.)	Croydon Duppas H.	Croydon (Whitgift)	Croydon (Park Hill)	Croydon (Outm. Rd.)	Addington Hills	Addington (Park Fm.)	Addington (Pump. St.)	West Wickham	Hayes Common
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
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19	·13	..	..	..	..	..	..	·02	·02	·04	..	·07	·02	..	..	..	..	..	..	..	..	..	..	..	..	..
20	..	..	·04	·02	..	·04	·03	·02	·03	·05	·02	..	·04	·07	·06	·04	·05	·04	·04	·05	·04	·02	..	..	·13	·02
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30	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
*	·20	·03	·10	·07	·06	·08	·10	·12	·07	·15	·08	·10	·09	·10	·09	·08	·07	·08	·09	·07	·08	·07	·04	·04	·16	·09
†	7·67	7·93	7·22	6·59	7·50	6·04	6·70	5·91	6·26	5·85	5·01	6·36	5·97	5·78	5·55	5·05	4·73	5·73	6·16	5·65	5·75	5·82	6·24	6·34	6·59	5·64

* The figures in this row give the totals for the month. † The totals from January 1st.

Daily Rainfall.

The 50 years (1841–90) mean at Greenwich for April is 1·66 in.

April, 1893.

Day of Mo.	Keston (Bradfield)	Keston (Heathfd.)	Keston (Tow. Fds.)	Orpington	Farning-ham Hill	Wilming-ton	Bickley	Bromley	Beckenham	South Norwood	Wimbledon (Sew. Wks.)	Wimbledon (Mt. Ararat)	Raynes Park	New Malden	Esher	Surbiton	Kingston	Richmond	Brixton	Wandswth. Common	West Norwood	Forest Hill Dartmh. rd.	Forest Hill (Nurseries)	Deptford	Greenwich	Eltham
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
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9	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
10	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
11	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
12	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
13	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
14	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
15	..	RECORD CEASED.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
16	·02		·02	·02	·02	·02	·02	·04	·02	·02	·02	·02	·03	·02	·02	..	·02	·03	·02	·03	·02	·03	·02	·02	·04	·01
17	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
18	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
19	..		..	..	..	..	..	..	..	..	·10	·02	·06	·02	..	..	·01	·01	·05	·03	·07	..	..	·06	·06	..
20	·09		·21	·04	..	·02	·03	·07	·04	·04	·02	·10	·09	·13	..	·03	·36	·19	·01	..	·01	..	..	..	..	..
21	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
22	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
23	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
24	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
25	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
26	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
27	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
28	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
29	·03		·02	·01	·03	·02	·03	·03	·02	·02	·02	·02	·04	..	·01	..	·02	·03	·02	·02	·02	·02	·02	·02	·02	·01
30	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
*	·14		·25	·07	·06	·06	·08	·14	·08	·08	·16	·16	·22	·17	·03	·03	·41	·26	·10	·08	·12	·05	·04	·10	·12	·02
†	6·06		6·57	5·96	5·28	4·18	5·90	5·80	4·93	5·29	4·92	5·09	5·73	3·92	4·18	3·81	4·88	4·66	4·75	4·85	5·20	4·96	5·63	4·39	4·67	4·67

* The figures in this row give the totals for the month.   † The totals from January 1st.

Daily Rainfall. *The 50 years (1841–90) mean at Greenwich for May is 2·01 in.* **May, 1893.**

Day of Mo.	Dorking	Reigate Hill	Caterham	Caterham Valley	Marden Park	Westerham	Coulsdon	Kenley	Purley (Reedham)	Purley (Tudor C.)	Ashtead	Oxshott	Banstead	Sutton	Wallington	Bedding-ton	Waddon	Croydon (Brim. Bn.)	Croydon Duppas H.	Croydon (Whitgift)	Croydon (Park Hill)	Croydon (Outm.Rd.)	Addington Hills	Addington (Park Fm.)	Addington (Pump.St.)	West Wickham
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	..	·03	..	·01	..	·02	·05	·05	·06	·06	·05	·06	·03	·02	·01	·02	·02	·02	·02	·03	·01	·02	·03	·03	·02
2	..	..	..	..	..	..	..	·01	·01	·02	..	..	..	..	..	..	..	..	..	..	..	..	·01	·01	..	..
3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
4	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
7	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
9	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
10	..	..	..	..	..	·05	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
11	..	..	..	..	..	·06	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
13	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
14	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
15	..	·01	·02	·02	..	..	..	·01	·01	..	..	·01	..	·01	·02	·01	·04	·02	·05	·03	..	·01	..	·08	..	..
16	·05	·05	·09	·14	·05	·12	·03	·07	·05	·04	·05	·07	..	·03	·02	·02	·02	..	·04	·04	·04	·03	·03	·04	·05	..
17	·36	·58	·22	·31	·21	..	·20	·17	·18	·16	·35	·33	·40	·47	·21	·14	·12	·14	·13	·13	·14	·13	·14	·14	·17	·21
18	·20	·08	·10	·09	·07	..	·09	·10	·11	·10	·09	·07	·07	·08	·08	·08	·05	..	·07	·06	·05	·07	·06	·05	·05	·07
19	·05	·04	·06	·09	·08	..	·06	·04	·02	·02	·04	·03	·02	·03	..	·01	·01	..	·01	..	·01	·01	·02	·03	·04	·05
20	·12	·02	·02	·06	·04	..	·02	·02	·03	·03	·17	·18	·01	·03	·01	..	..	..	·01	..	·02	·03	·04	·01	·01	·09
21	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
22	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
23	..	..	..	..	..	..	..	..	·01	·02	·02	·02	..	·03	·02	·03	·03	·11	·04	·05	·04	·05	·02	·01	..	·01
24	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
25	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
26	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
27	..	..	..	..	..	..	..	..	..	..	..	..	·10	..	..	..	..	..	..	..	..	..	..	..	..	..
28	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
29	·02	·14	·56	1·03	·56	·72	·30	·50	·55	·45	·06	·05	·19	·32	·25	·33	·31	·30	·34	·37	·39	·35	·33	·28	·29	·22
30	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
31	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
*	·80	·92	1·10	1·74	1·02	·95	·72	·97	1·02	·90	·84	·81	·85	1·03	·63	·63	·60	·59	·71	·70	·72	·69	·67	·68	·64	·67
†	8·47	..	9·03	8·96	7·61	8·45	6·76	7·67	6·93	7·16	6·69	5·82	7·21	7·00	6·41	6·18	5·65	5·32	6·44	6·86	6·37	6·44	6·49	6·92	6·98	7·26

* The figures in this row give the totals for the month. † The totals from January 1st.

Daily Rainfall. *The 50 years (1841–90) mean at Greenwich for May is 2·01 in.* **May, 1893.**

Day of Mo.	Hayes Common	Keston (Bradfield)	Keston (Tow. Fds.)	Orpington	Farningham Hill	Wilmington	Bickley	Bromley	Beckenham	South Norwood	Wimbledon (Sew. Wks.)	Wimbledon (Mt. Ararat)	Raynes Park	New Malden	Esher	Surbiton	Kingston	Richmond	Brixton	Wandswth. Common	West Norwood	Forest Hill Dartmh. rd.	Forest Hill (Nurseries)	Deptford	Greenwich	Eltham
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·01	·02	·01	..	..	..	·02	·02	·01	·02	..	·01	·03	..	..	..	·01	·02	·01	·01	..	..	..	..	·01	..
2	..	·01	·01	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	..	..	..
3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
4	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
7	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
9	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
11	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
13	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
14	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
15	..	..	..	..	·01	..	..	..	·01	..	·01	..	·02	·01	·03	·04	·02	·03	·01	·01	..	..	..	..	·01	..
16	·02	·02	·02	·01	·03	·01	·02	·03	·03	·03	·07	·02	·05	·03	·06	·03	·06	·07	·06	·09	·05	·05	·04	·04	·04	·02
17	·16	·18	·15	·12	·09	·14	·17	·17	·12	·13	·26	·48	·45	·30	·38	·32	·37	·70	·15	·19	·15	·15	·09	·13	·27	·24
18	·05	·08	·05	·07	·03	·02	·05	·05	·03	·05	·05	·05	·09	·02	·02	·03	·02	·02	·03	·06	·05	·04	..	·02	·02	·02
19	·04	..	·05	·10	·01	·02	·01	·02	·01	·01	..	..	·03	..	·17	·03	·03	·05	..	·01	·01	..	·02	·01	·02	..
20	·05	·02	·07	·01	·01	..	·01	·02	..	..	..	·03	·03	·10	·05	·09	·12	·10	·03	·02	..	·03	·01	·01	·01	..
21	..	..	..	..	·02	·01	..	..	..	..	..	..	..	..	·02	..	..	·03	..	..	..	..	·02	..	·02	..
22	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
23	·02	·01	·01	..	..	·02	·05	·04	·04	·05	·04	·05	·05	·03	·02	·03	·02	·04	·01	·02	·05	·05	·05	·02	·02	·03
24	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
25	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·04	..	..	..	..	..
26	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
27	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
28	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
29	·14	·12	·11	·45	·90	·24	·15	·13	·11	·22	·15	·20	·22	·63	·23	1·02	·96	·20	·17	·25	·19	·16	·17	·15	·13	·10
30	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
31	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
*	·49	·46	·48	·77	1·10	·46	·48	·48	·36	·51	·58	·84	·97	1·12	·98	1·59	1·61	1·27	·47	·66	·54	·48	·40	·38	·53	·41
†	6·13	6·52	7·05	6·73	6·38	4·64	6·38	6·28	5·29	5·80	5·50	5·93	6·70	5·04	5·16	5·40	6·49	5·93	5·22	5·51	5·74	5·44	6·03	4·77	5·20	5·08

* The figures in this row give the totals for the month. † The totals from January 1st.

Day of Mo.	Dorking	Reigate Hill	Caterham	Caterham Valley	Marden Park	Westerham	Coulsdon	Kenley	Purley (Reedham)	Purley (Tudor C.)	Ashtead	Oxshott	Banstead
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	..	..	..	..	..	..	..	..	..	..	..	..
2	..	..	..	..	..	..	..	..	..	..	..	..	..
3	·02	·03	·03	..	·02	..	·04	·04	·05	·03	·05	·07	·02
4	..	..	..	..	..	..	..	..	..	..	..	..	..
5	..	..	..	..	..	..	..	..	..	..	..	..	..
6	·09	·03	·04	·05	·01	·04	·03	·02	·03	..	·05	·06	·04
7	..	..	..	..	..	..	..	..	..	..	..	..	..
8	..	..	..	..	..	..	..	..	..	..	..	..	..
9	..	..	..	..	..	..	..	..	..	..	..	..	..
10	..	..	..	..	..	..	..	..	..	..	..	..	..
11	..	..	..	..	..	..	..	..	..	..	..	..	..
12	..	·01	·03	..	..	..	..	..	..	..	..	..	..
13	..	..	..	..	..	..	..	..	..	..	..	..	..
14	..	..	..	..	..	..	..	..	..	..	..	..	..
15	..	..	..	..	..	..	..	..	..	..	..	..	..
16	..	..	..	..	..	..	..	..	..	..	..	..	..
17	..	..	..	..	..	..	..	..	..	..	..	..	..
18	..	..	..	..	..	..	..	..	..	..	..	..	..
19	..	..	..	..	..	..	..	·01	..	·02	..	·01	·01
20	..	..	..	..	..	..	..	..	..	..	·01	..	..
21	..	..	..	..	..	·42	..	..	..	..	..	..	..
22	·21	·28	·32	·31	·31	·01	·24	·25	·29	·29	·38	·35	·31
23	..	·01	·01	..	..	..	..	·01	..	·01	..	..	..
24	·07	·05	·09	·09	·08	·03	·14	·27	·32	·35	·19	·18	·17
25	·02	·01	..	·03	..	·03	..	·01	·01	·02	·01	·01	..
26	·10	·09	·11	·07	·08	·16	·07	·08	·06	·06	·06	·05	·06
27	·43	·26	·37	·39	·40	·35	·24	·24	·20	·21	·18	·30	·26
28	..	..	..	..	..	..	..	..	..	·02	..	..	..
29	..	..	..	..	..	..	..	..	..	..	..	..	..
30	..	..	..	..	..	..	..	..	..	..	..	..	..
*	·94	·77	1·00	·94	·90	1·04	·76	·93	·96	1·01	·93	1·03	·87
†	9·41	..	10·03	9·90	8·51	9·49	7·52	8·60	7·89	8·17	7·62	6·85	8·08

Day of Mo.	Sutton	Wallington	Beddington	Waddon	Croydon (Brim. Bn.)	Croydon Duppas H.	Croydon (Whitgift)	Croydon (Park Hill)	Croydon (Outm. Rd.)	Addington Hills	Addington (Park Fm.)	Addington (Pump. St.)	West Wickham
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	..	..	..	..	..	..	..	..	..	..	..	..
2	..	..	..	..	..	..	..	..	..	..	..	..	..
3	·06	·07	·06	·06	·06	·06	·05	·05	·05	·05	·04	·04	·05
4	..	..	..	..	..	..	..	..	..	..	..	..	..
5	..	..	..	..	..	..	..	..	..	..	..	..	..
6	·06	·02	·02	·02	·02	·02	·01	·01	·01	·03	·03	·01	·07
7	..	..	..	..	..	..	..	..	..	..	·03	..	..
8	..	..	..	..	..	..	..	..	..	..	..	..	..
9	..	..	..	..	..	..	..	..	..	..	..	..	..
10	..	..	..	..	..	..	..	..	..	..	..	..	..
11	..	..	..	..	..	..	..	..	..	..	..	..	..
12	..	..	..	..	..	..	..	..	..	..	..	..	..
13	..	..	..	..	..	..	..	..	..	..	..	..	..
14	..	..	..	..	..	..	..	..	..	..	..	..	..
15	..	..	..	..	..	..	..	..	..	..	..	..	..
16	..	..	..	..	..	..	..	..	..	..	..	..	..
17	..	..	..	..	..	..	..	..	..	..	..	..	..
18	..	..	..	..	..	..	..	..	..	..	..	..	..
19	·01	..	..	..	..	..	..	..	..	·01	..	..	·01
20	..	..	..	..	..	..	..	..	..	..	·01	..	..
21	..	..	..	..	..	..	..	..	..	..	..	..	..
22	·39	·36	·34	·33	·36	·34	·37	·34	·33	·30	·28	·24	·28
23	..	·02	·02	·02	·03	·03	·04	·03	·03	·02	·02	·01	..
24	·25	·21	·24	·25	·12	·15	·11	·10	·07	·15	·15	·14	·12
25	·02	·01	·01	·01	..	·01	·01	·05	·02	·01	·01	·01	..
26	·07	·05	·05	·03	·06	·06	·05	·05	·05	·05	·06	·07	·06
27	·29	·20	·19	·18	·19	·20	·20	·20	·21	·24	·23	·29	·40
28	..	..	..	..	..	..	..	..	..	..	..	..	..
29	..	..	..	..	..	..	..	..	..	..	..	..	..
30	..	..	..	..	..	..	..	..	..	..	..	..	..
*	1·15	·94	·93	·90	·84	·87	·84	·83	·77	·86	·86	·81	·99
†	8·15	7·35	7·11	6·55	6·16	7·31	7·70	7·20	7·21	7·35	7·78	7·79	8·25

* The figures in this row give the totals for the month. † The totals from January 1st.

Daily Rainfall. *The 50 years (1841–90) mean at Greenwich for June is 2·02 in.* **June, 1893.**

Day of Mo.	Hayes Common	Keston (Bradfield)	Keston (Tow. Fds.)	Orpington	Farningham Hill	Wilmington	Bickley	Bromley	Beckenham	South Norwood	Wimbledon (Sew. Wks.)	Wimbledon (Mt. Ararat)	Raynes Park	New Malden	Esher	Surbiton	Kingston	Richmond	Brixton	Wandswth. Common	West Norwood	Forest Hill Dartmh. rd.	Forest Hill (Nurseries)	Deptford	Greenwich	Eltham
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··
2	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··
3	·05	·04	·04	·02	·02	·01	·02	·04	··	·05	·04	·04	·06	·06	·05	·07	·05	·02	·01	··	·03	·02	·01	··	··	··
4	··	··	··	··	··	··	·01	·04	·04	··	··	··	·02	·01	·02	·02	··	·01	··	··	··	··	··	··	·01	··
5	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··
6	·11	·01	·12	·12	·01	·01	·10	·09	·09	·03	·03	·04	·05	·08	·05	·02	·10	·03	·10	·03	·06	·11	·11	·13	·17	·11
7	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··
8	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··
9	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··
10	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··
11	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··
12	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··
13	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··
14	··	··	··	··	·02	··	··	··	··	··	··	··	·01	··	··	··	··	·04	··	··	··	··	··	··	··	··
15	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··
16	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··
17	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··
18	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··
19	··	·01	··	··	·01	··	··	·01	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	·01	·02	·01
20	··	··	··	··	··	··	··	··	··	··	··	··	··	··	·01	··	··	··	··	··	··	··	··	··	··	··
21	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	·01	··	··	··	··	··	··	··	··
22	·23	·22	·23	·17	·46	·27	·46	·53	·55	·62	·35	·36	·42	·37	·34	·47	·36	·25	·34	·27	·46	·45	·51	·30	·32	·40
23	·03	·02	·02	·08	·01	·02	·03	·03	·03	·03	·04	·04	·06	·03	·05	·04	·02	·05	·04	·05	·08	·13	··	·03	·04	·06
24	·09	·10	·11	·07	·03	·01	·03	·04	·04	·07	·04	·08	·11	·10	·09	·19	·07	·06	·02	·04	·03	·05	·05	·03	·02	·04
25	·01	·01	··	·01	·02	·02	·02	·03	·02	·01	·02	·02	·03	·02	·02	··	·02	·02	·01	·03	·02	·02	·01	·02	·02	·02
26	·04	·04	·01	·05	·04	·04	·04	·05	·03	·05	·04	·04	·05	·03	·06	·06	·07	·06	·05	·05	·04	·05	·04	·04	·05	·04
27	·24	·18	·32	·30	·23	·21	·16	·17	·17	·18	·27	·28	·27	·29	·30	·33	·28	·24	·29	·20	·23	·20	·19	·14	·17	·20
28	··	··	··	··	··	··	··	·01	··	··	·01	··	·02	··	··	··	·01	·04	·01	·01	··	··	··	··	··	··
29	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··
30	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··	··
*	·80	·63	·85	·82	·85	·59	·87	1·04	·97	1·04	·84	·90	1·10	·99	·99	1·20	·98	·83	·87	·68	·95	1·03	·92	·70	·82	·88
†	6·93	7·15	7·90	7·55	7·23	5·23	7·25	7·32	6·26	6·84	6·34	6·83	7·80	6·03	6·15	6·60	7·47	6·76	6·09	6·19	6·69	6·47	6·95	5·47	6·02	5·96

* The figures in this row give the totals for the month. † The totals from January 1st.

Day of Mo.	Dorking	Reigate Hill	Caterham	Caterham Valley	Marden Park	Westerham	Coulsdon	Kenley	Purley (Reedham)	Purley (Tudor C.)	Ashtead	Oxshott	Banstead	Sutton	Wallington	Bedding-ton	Waddon	Croydon (Brim. Bn.)	Croydon Duppas H.	Croydon (Whitgift)	Croydon (Park Hill)	Croydon (Outm.Rd.)	Addington Hills	Addington (Park Fm.)	Addington (Pump.St.)	West Wickham
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
4	·30	·31	·34	·32	·34	·37	·36	·34	·34	·36	·23	·23	·29	·33	·29	·29	·28	·30	·29	·30	·27	·26	·30	·32	·31	·32
5	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
6	..	..	..	..	..	..	..	..	..	..	·03	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
7	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
8	·16	·12	·25	·46	·20	·22	·24	·31	·26	·32	·10	·09	·39	·38	·36	·33	·36	·45	·37	·37	·20	·16	·18	·16	·18	·20
9	·16	·03	·17	·07	·07	·11	·03	·01	·05	·05	·15	·12	·11	·12	·17	·15	·08	·13	·07	·06	·02	·02	·02	·08	·14	·12
10	..	..	..	..	..	..	..	..	..	..	·05	.02	..	..	..	·03	·02	..	·01	..	..	..	..	..	..	..
11	·31	·46	·35	·37	·28	·26	·37	·26	·35	·30	·44	·42	·27	·18	·29	·30	·18	..	·17	·19	·20	·22	·25	·25	·26	·27
12	·07	·16	1·10	·96	·53	·25	·98	·36	·30	·23	·04	·05	·18	·41	·13	·29	·38	·36	·36	·32	·29	·23	·27	·12	·13	·22
13	..	..	..	..	..	..	..	·01	·01	·02	..	..	..	..	·01	·01	·02	·02	·02	·01	·01	·01	·01	..	..	..
14	·02	..	·03	·04	·01	..	·03	·02	·03	·04	·04	·02	·04	·07	·03	·02	·03	·03	·02	·03	·02	·02	·03	·02	·02	·03
15	·23	·03	·11	·19	·15	·24	·14	·15	·08	·14	·14	·12	·10	·11	·10	·09	·10	·10	·10	·10	·09	·10	·12	·06	·09	·08
16	..	·26	·08	·05	·04	..	·03	·01	·05	·02	·06	·08	·04	·06	·06	·07	·06	·06	·06	·07	·05	·04	·04	·10	·05	·08
17	·02	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
18	·07	·05	·10	·06	·08	·07	·05	·06	·05	·05	·05	·05	·05	·05	·04	·04	·03	·04	·04	·04	·03	·03	·05	·04	·05	·02
19	·30	·30	·31	·20	·25	·47	·24	·24	·17	·20	·17	·16	·16	·12	·12	·11	·10	·10	·13	·13	·13	·13	·15	·17	·18	·22
20	·41	·25	·20	·15	·12	..	·26	·22	·27	·31	·11	·07	·24	·11	·08	·07	·07	·09	·11	·10	·16	·17	·23	·25	·23	·23
21	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
22	..	..	..	..	..	·50	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
23	·32	·49	·54	·42	·46	·20	·36	·33	·36	·35	·29	·32	·40	·25	·24	·21	·20	·20	·22	·23	·23	·23	·23	·27	·28	·34
24	..	..	..	..	..	·02	..	·02	..	..	·03	..	..	·02	..	..	·01	·02	..	..	·01	·01	..	·01	·01	..
25	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
26	·15	·12	..	·05	..	·10	·04	·11	·08	·16	·28	·23	..	·07	·12	·11	·16	·21	·16	·12	·06	·07	·04	·04	·02	·06
27	..	..	..	..	·02	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
28	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
29	·11	·18	·16	·16	·14	·22	·16	·14	·11	·17	·17	·16	·13	·17	·18	·17	·19	·22	·18	·22	·20	·20	·16	·20	·28	·23
30	..	..	..	·09	..	..	..	..	..	·03	·01	..	..	..	..	·01	·02	·01	·01	..	..	..	..	..	..	..
31	·02	·03	·12	·08	·10	·10	·13	·09	·11	·09	·02	·05	01	·01	·11	·13	·14	·04	·11	·12	·07	·05	·07	·06	·06	·08
*	2·65	2·80	3·86	3·67	2·79	3·13	3·42	2·68	2·62	2·84	2·41	2·19	2·41	2·46	2·33	2·43	2·43	2·48	2·43	2·41	2·04	1·95	2·15	2·15	2·29	2·50
†	12·06	..	13·89	13·57	11·30	12·62	10·94	11·28	10·51	11·01	10·03	9·04	10·49	10·61	9·68	9·54	8·98	8·64	9·74	10·11	9·24	9·16	9·50	9·93	10·08	10·75

* The figures in this row give the totals for the month. † The totals from January 1st.

Daily Rainfall. *The 50 years (1841–90) mean at Greenwich for July is 2·48 in.* **July, 1893.**

Day of Mo.	Hayes Common	Keston (Bradfield)	Keston (Tow. Fds.)	Orpington	Farningham Hill	Wilmington	Bickley	Bromley	Beckenham	South Norwood	Wimbledon (Sew. Wks.)	Wimbledon (Mt. Ararat)	Raynes Park	New Malden	Esher	Surbiton	Kingston	Richmond	Brixton	Wandswth. Common	West Norwood	Forest Hill Dartmh. rd.	Forest Hill (Nurseries)	Deptford	Greenwich	Eltham
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
4	·33	·36	·35	·31	·25	·16	·30	·30	·25	·27	·27	·30	·32	·24	·19	·23	·30	·25	·29	·26	·28	·26	·27	·22	·24	·20
5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	..
6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
7	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
8	·14	·16	·15	·58	·26	·45	·13	·14	·17	·29	·14	·09	·16	·16	·26	·63	·35	·16	·31	·14	·45	·32	·27	·48	·38	·13
9	·19	·09	·09	·02	·04	·11	·09	·07	·01	·07	·15	·15	·15	·16	·06	·17	·01	·06	·05	·07	·07	·12	·02	·17	·10	·03
10	..	..	..	..	..	..	..	..	..	·01	..	·01	·06	·03	..	..	..	..	..	..	·02	·03	..	·01	..	·01
11	·21	·31	·21	·17	·20	·15	·45	·39	·16	·26	·25	·19	·19	·18	·36	·30	·27	·09	·20	·24	·17	·25	·19	·20	·34	·33
12	·21	·19	·16	·10	·05	·37	·33	·32	·27	·20	·28	·19	·17	·48	·03	·13	·81	·21	·13	·20	·13	1·15	·74	1·75	·95	·25
13	..	..	..	..	..	..	..	·01	..	·02	·01	·01	·02	..	·01	..	..	·01	·02	·03	·02	·01	·02	..	..	..
14	·02	·02	·02	·02	·01	..	..	..	·01	·02	..	·02	·04	·02	·03	..	·01	·02	·01	·02	·01	·02	·01	·01	·01	·01
15	·10	·09	..	·08	·13	·05	·07	·07	·05	·11	..	·07	·08	·07	·10	·12	·12	·08	·03	·10	·07	·04	..	·03	·07	·04
16	·06	·04	·14	·09	·08	·06	·06	·06	·06	·02	·11	·06	·08	·05	·05	·03	·01	·02	·09	·03	·06	·10	·16	·10	·06	·06
17	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	·01	..	..	..	..	..	..
18	·03	·03	..	..	·02	·02	·04	·05	·06	·06	·06	·04	·06	·04	·04	·03	·05	·08	·05	·04	·05	·06	..	·05	·05	·06
19	·10	·11	·15	·16	·14	·05	·11	·11	·10	·12	·11	·13	·16	·09	·14	·10	·15	·17	·14	·10	·17	·15	·14	·15	·16	·16
20	·23	·13	·16	·09	·11	·15	·15	·13	·08	·09	·10	·10	·17	·09	·05	·10	·10	·16	·11	·10	·23	·25	·29	·15	·16	·08
21	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	·02	..	..	..	..	..	..	·01	..
22	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
23	·24	·21	·23	·18	·25	·23	·23	·22	·18	·18	·25	·23	·24	·20	·21	·20	·20	·36	·34	·24	·27	·32	·31	·24	·28	·26
24	..	..	..	..	..	..	..	·01	..	..	..	..	·02	..	..	..	..	..	..	..	..	..	..	..	..	..
25	..	..	..	..	..	..	..	..	..	·03	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
26	·05	·12	·20	·15	·10	·21	·19	·17	·12	·05	·04	·18	·20	·05	·08	·04	·02	·21	·07	·19	·18	·23	·29	·09	·07	·18
27	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
28	·10	..	..	..	·01	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
29	21	·22	·20	·11	·15	·09	·13	·14	·14	·20	·30	·22	·16	·09	·16	·30	·14	·06	·22	·18	·25	·22	·26	·19	·25	·17
30	..	..	·01	·10	·35	·08	·04	·05	·02	..	·01	..	·01	·02	·02	..	..	..	..	·01	..	·04	..	·03	·15	·26
31	·08	·07	·05	·06	·02	..	·06	·07	·05	·02	·14	·11	·13	·03	·04	..	..	·04	·03	·08	·02	·04	·04	·11	·05	..
*	2·30	2·15	2·12	2·22	2·17	2·18	2·38	2·31	1·74	2·02	2·22	2·10	2·43	2·00	1·83	2·38	2·54	2·00	2·10	2·05	2·45	3·61	3·01	3·98	3·33	2·23
†	9·23	9·30	10·02	9·77	9·40	7·41	9·63	9·63	8·00	8·86	8·56	8·93	10·23	8·03	7·98	8·98	10·01	8·76	8·19	8·24	9·14	10·08	9·96	9·45	9·35	8·19

* The figures in this row give the totals for the month. † The totals from January 1st.

Daily Rainfall. *The 50 years (1841–90) mean at Greenwich for August is 2·34 in.* August, 1893.

Day of Mo.	Dorking	Reigate Hill	Caterham	Caterham Valley	Marden Park	Westerham	Coulsdon	Kenley	Purley (Reedham)	Purley (Tudor C.)	Ashtead	Oxshott	Banstead	Sutton	Wallington	Bedding-ton	Waddon	Croydon (Brim. Bn.)	Croydon Duppas H.	Croydon (Whitgift)	Croydon (Park Hill)	Croydon (Outm.Rd.)	Addington Hills	Addington (Park Fm.)	Addington (Pump.St.)	West Wickham
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·07	·08	·10	·08	·08	·02	·08	·09	·06	..	·06	·07	·08	·06	·06	·05	·05	·04	·06	·04	·05	·04	·08	·10	·05	·03
2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
3	·10	·06	·06	·05	·05	..	·04	·04	·03	·10	·05	·05	·08	·05	·07	·06	·05	·05	·05	·05	·05	·06	·04	·03	·04	·05
4	·22	·12	·08	·10	·04	·59	·07	·16	·23	·15	·16	·26	·07	·05	·04	·03	·03	·04	·03	·03	·03	·03	·11	·13	·13	·10
5	..	..	..	·01	·06	..	·07	·06	·04	..	..	..	·04	·04	·05	·02	·02	..	·01	..	..	..	..	..	·01	·03
6	·03	..	..	·01	·01	..	·02	..	..	..	·01	·01	..	..	·01	·01	..	..	·01	..	..	·01	..	·01	..	..
7	..	..	..	·03	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
9	·02	..	..	..	..	..	..	..	..	·07	·01	·03	..	·07	·09	·13	·05	·06	·04	·03	..	..	..	..	..	..
10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
11	·02	..	·02	·01	·02	..	·02	·04	·04	·04	..	·02	..	·05	·04	·04	·04	·05	·04	·05	·05	·05	·05	·04	·04	·04
12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	..	..
13	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
14	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
15	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
16	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
17	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
18	..	..	·01	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..
19	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
20	·07	·02	·05	·02	·06	..	·02	·03	·02	·03	·03	·04	·04	·03	·02	·02	·01	·01	·01	·02	·01	·01	·02	·03	·03	·02
21	..	·03	·02	·05	..	..	·01	·04	·01	·06	·01	·02	01	·01	·01	·01	..	..	·02	·02	·02	·02	·02	..	·01	·04
22	..	·03	·03	·09	..	..	..	..	..	..	·10	..	..	·01	·01	·02	·02	..	·02	·02	·04	·02	·01	..	·02	·04
23	·23	·19	·11	·05	·07	..	·20	·15	·17	·17	·15	·22	·16	·18	·11	·10	·14	·14	·13	·15	·15	·17	·23	·13	·12	·05
24	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	·02	·01	·01	..	·01	..	..	..	·02	..	..	..
25	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·02	..	..	..	..	..	..
26	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
27	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	·02	·02	·03	·03	·03	·02	·01	..	..
28	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
29	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
30	..	·02	·02	·03	·03	..	·01	..	·01	..	·01	..	..	..	..	..	..	..	·01	·01	..	·01	·01	..	..	·01
31	·06	·09	·10	·13	·07	·01	·09	·10	·08	·10	·10	·11	·10	·10	·08	·09	·10	·10	·10	·09	·08	·07	·11	·10	·10	·11
*	·82	·64	·60	·67	·49	·62	·63	·72	·69	·72	·69	·83	·58	·65	·61	·59	·53	·51	·57	·56	·51	·52	·72	·59	·55	·52
†	12·88	..	14·49	14·24	11·79	13·24	11·57	12·00	11·20	11·73	10·72	9·87	11·07	11·26	10·29	10·13	9·51	9·15	10·31	10·67	9·75	9·68	10·22	10·52	10·63	11·27

* The figures in this row give the totals for the month. † The totals from January 1st.

Daily Rainfall. *The 50 years (1841–90) mean at Greenwich for August is 2·34 in.* **August, 1893.**

Day of Mo.	Hayes Common	Keston (Bradfield)	Keston (Tow. Fds.)	Orpington	Farning-ham Hill	Wilming-ton	Bickley	Bromley	Beckenham	South Norwood	Wimbledon (Sew. Wks.)	Wimbledon (Mt. Ararat)	Raynes Park	New Malden	Esher	Surbiton	Kingston	Richmond	Brixton	Wandswth. Common	West Norwood	Forest Hill Dartmh. rd.	Forest Hill (Nurseries)	Deptford	Greenwich	Eltham
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·06	·06	·06	·06	·04	·05	·04	·03	·02	·02	·02	·03	·05	·01	·03	..	·02	·04	·04	·04	·03	·03	·02	·04	·04	·03
2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
3	..	·04	·04	·03	·02	..	·02	·03	·04	·07	·04	·05	..	·03	·06	·04	·07	·10	·04	·04	·04	·05	·06	..	·04	·05
4	·11	·09	·11	·08	·10	·08	·05	·03	·06	·09	·40	·36	·33	..	·48	·45	·47	·78	·73	·56	·51	·39	·33	·63	·53	·19
5	·01	..	..	·02	·13	..	·10	·12	·01	..	·01	·01	·03	..	·04	·06	..	·02	·11	·04	·01	·07	·07	·06	·01	·07
6	·01	..	..	·01	..	..	·02	·02	..	·01	..	·02	·04	·01	·02	..	·01	·02	·02	·02	·01	..	..	..	·01	..
7	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..
9	..	..	·01	·04	..	..	..	..	..	·06	·01	..	·01	..	·02	..	..	·01	·11	·13	·07	·03	·02	·22	·10	..
10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
11	·05	·05	·06	·06	·05	·09	·07	·08	·07	·01	·05	·07	·07	·04	·05	·06	·06	·06	·05	·07	·06	·06	·05	·05	·07	·07
12	..	..	..	..	..	·01	..	..	..	..	..	..	·01	..	·01	·01	..	·05	·03	·01	..	..	..	..	..	..
13	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..
14	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
15	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
16	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
17	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
18	..	..	..	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
19	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
20	..	·03	·02	·02	·01	..	·01	·01	·01	·01	·02	·04	·06	·03	·05	·04	·04	·06	·02	·02	·02	·02	·01	·01	·02	..
21	..	..	·01	·02	..	..	..	·01	..	·01	·03	·01	·03	·01	·02	..	·01	·03	·01	..	·02	..	·01	..	..	..
22	..	·02	..	·07	..	·05	..	·01	..	·02	·04	·03	·05	..	·03	..	..	·01	·01	·04	..	·04	·03	·02	·02	..
23	..	·05	·07	·08	·03	·01	·05	·09	·10	·13	·25	·26	·30	·21	·25	·26	·34	·41	·32	·29	·17	·20	·22	·20	·29	·08
24	·01	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	..	..	·01	..	..	..	..	..
25	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
26	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
27	..	..	..	..	·01	..	..	..	..	·02	·02	..	..	..	..	..	..	..	·02	·01	·02	·04	·01	..	..	·01
28	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
29	..	..	..	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
30	·02	·02	·02	..	..	..	..	..	..	·01	·01	..	..	..	..	..	·01	..	·03	·01	..	·01	·01	..	..	..
31	·10	·09	·09	·18	·25	·39	·19	·19	·10	·10	·10	·08	·10	·10	·08	·10	·07	·13	·12	·08	·11	·17	·15	·16	·25	·27
*	·37	·45	·49	·67	·65	·68	·55	·64	·41	·56	1·00	·96	1·10	·44	1·14	1·02	1·10	1·72	1·66	1·36	1·08	1·11	·99	1·40	1·38	·77
†	9·60	9·75	10·51	10·44	10·05	8·09	10·18	10·27	8·41	9·42	9·56	9·89	11·33	8·47	9·12	10·00	11·11	10·48	9·85	9·60	10·22	11·19	10·95	10·85	10·73	8·96

* The figures in this row give the totals for the month. † The totals from January 1st.

Daily Rainfall. *The 50 years (1841–90) mean at Greenwich for September is 2·25 in.* September, 1893.

Day of Mo.	Dorking	Reigate Hill	Caterham	Caterham Valley	Marden Park	Westerham	Coulsdon	Kenley	Purley (Reedham)	Purley (Tudor C.)	Ashtead	Oxshott	Banstead	Sutton	Wallington	Bedding-ton	Waddon	Croydon (Brim. Bn.)	Croydon Duppas H.	Croydon (Whitgift)	Croydon (Park Hill)	Croydon (Outm.Rd.)	Addington Hills	Addington (Park Fm.)	Addington (Pump.St.)	West Wickham
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	..	..	..	·03	..	..	..	..	·02	..	..	..	..	·01	..	·01	..	·01	..	..	·01	..	·01	..	·01
2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
4	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
6	·07	·08	·06	·09	·04	·03	·03	·02	·01	·03	·02	.02	01	..	·01	·01	..	..	·01	·01	·01	·01	·01	·01	..	·01
7	..	..	·04	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	..
8	·21	·12	·14	·09	·10	·31	·16	·14	·11	·15	·17	·13	·11	·14	·14	·12	·11	·13	·12	·12	·12	·12	·14	·18	·15	·12
9	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
11	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
13	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
14	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
15	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
16	·20	·30	·25	·29	·25	·34	·29	·28	·26	·30	·18	·19	·30	·30	·28	·22	·25	·25	·23	·27	·29	·34	·28	·27	·23	·30
17	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	·01	..	..	..	..	..	..	..	..	..
18	..	..	..	·02	..	..	..	..	..	·02	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
19	..	·05	..	·04	·02	·06	..	·01	·01	·01	·02	·02	..	..	..	..	..	..	..	..	..	..	..	..	·01	·02
20	·06	·25	·21	·22	·16	·16	·18	·21	·20	·12	·13	·12	·13	·12	·09	·07	·08	·06	·07	·06	·08	·07	·19	·30	·17	·09
21	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
22	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
23	·08	·04	..	..	·03	..	..	·05	·05	·13	·10	·09	·06	·10	·09	·09	·09	·08	·08	·08	·07	·07	·06	·06	·04	·03
24	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
25	..	·01	·01	·03	..	..	..	..	..	..	·01	..	..	..	..	..	..	..	·01	..	..	..	..	·01	..	..
26	·25	·20	·23	·24	·11	·36	·20	·20	·15	·01	·30	·28	·22	·28	·26	·24	·23	·25	·24	·25	·25	·24	·28	·30	·24	·22
27	·03	·02	..	·02	..	..	..	..	·01	·21	·01	..	..	..	·01	·01	·01	..	·01	..	..	·01	..	·01	·01	..
28	·44	·37	·33	·25	·32	·48	·44	·47	·45	·38	·31	·24	·36	·26	·32	·30	·26	·30	·30	·32	·29	·30	·36	·43	·42	·41
29	·19	·19	·15	·22	·09	·38	·16	·18	·20	·13	·10	·12	·14	·17	·14	·12	·09	·13	·11	·11	·09	·13	·19	·16	·17	·24
30	·04	·04	..	·06	·06	·04	·01	·02	·03	·20	·02	·01	..	..	..	..	·01	..	..	..	..	..	..	·01	·01	·01
*	1·57	1·67	1·42	1·57	1·22	2·16	1·47	1·58	1·48	1·71	1·38	1·22	1·33	1·37	1·35	1·18	1·15	1·20	1·19	1·23	1·20	1·30	1·51	1·75	1·45	1·46
†	14·45	..	15·91	15·81	13·01	15·40	13·04	13·58	12·68	13·44	12·10	11·09	12·40	12·63	11·64	11·31	10·66	10·35	11·50	11·90	10·95	10·98	11·73	12·27	12·08	12·73

Day of Mo.	Hayes Common	Keston (Bradfield)	Keston (Tow. Fds.)	Orpington	Farningham Hill	Wilmington	Bickley	Bromley	Beckenham	South Norwood	Wimbledon (Sew. Wks.)	Wimbledon (Mt. Ararat)	Raynes Park
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	·01	·01	..	..	..	·02	·02	·01	..	..	..	·02
2	..	..	..	..	..	..	..	..	..	..	..	..	..
3	..	..	..	..	..	..	..	..	..	..	..	..	..
4	..	..	..	..	..	..	..	..	..	..	..	..	..
5	..	..	..	..	..	..	..	..	..	..	..	..	..
6	..	·06	·01	·01	·01	..	·02	·03	·02	·02	·02	..	·02
7	..	..	..	..	..	..	..	..	..	·01	·01	..	·02
8	·14	·14	·14	·15	·12	·10	·09	·11	·09	·10	·17	·19	·23
9	..	..	..	..	..	..	..	..	..	..	..	..	..
10	..	..	..	..	..	..	..	..	..	..	..	..	..
11	..	..	..	..	..	..	..	..	..	..	..	..	..
12	..	..	..	..	..	..	..	..	..	..	..	..	..
13	..	..	..	..	..	..	..	..	..	..	..	..	..
14	..	..	..	..	..	..	..	..	..	..	..	..	..
15	..	..	..	..	·01	..	..	..	..	..	..	·01	..
16	·25	·28	·27	·28	·30	·29	·21	·25	·22	·28	·30	·22	·25
17	..	..	..	..	..	..	..	..	..	..	..	..	..
18	..	..	..	..	..	..	..	..	..	..	..	..	..
19	..	·01	·01	..	·01	..	..	..	..	..	·06	·03	·12
20	·11	·08	·08	·03	·06	·01	·04	·05	·04	·05	·05	·06	·09
21	..	..	..	..	..	..	..	..	..	..	..	..	..
22	..	..	..	..	..	..	..	·01	..	·01	..	..	..
23	·05	·03	·03	·03	·02	·02	·05	·06	·07	..	·09	·08	·11
24	..	..	..	..	..	..	..	·01	..	..	..	..	..
25	..	..	·01	..	..	..	·01	·01	..	..	..	..	·02
26	·23	·20	·25	·22	·19	·24	·21	·22	·18	·21	·20	·16	·19
27	..	..	..	..	..	..	..	·01	..	..	..	..	·01
28	·33	·33	·38	·37	·34	·20	·31	·29	·22	·26	·14	·15	·17
29	·12	·12	·09	·18	·21	·12	·09	·17	·12	·16	·10	·10	·15
30	..	..	..	..	·04	..	..	..	·01	·02	·02	·02	·03
*	1·23	1·26	1·28	1·27	1·31	·98	1·05	1·24	·98	1·12	1·16	1·02	1·43
†	10·83	11·01	11·79	11·71	11·36	9·07	11·23	11·51	9·39	10·54	10·72	10·91	12·76

Day of Mo.	New Malden	Esher	Surbiton	Kingston	Richmond	Brixton	Wandswth. Common	West Norwood	Forest Hill Dartmh. rd.	Forest Hill (Nurseries)	Deptford	Greenwich	Eltham
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·01	·01	·01	·02	..	..	·01	..	·02	·01	..	..	..
2	..	..	..	..	..	..	..	..	..	..	..	..	..
3	..	..	..	..	..	..	..	..	..	..	..	..	..
4	..	..	..	..	..	..	..	..	..	..	..	..	..
5	..	..	..	..	..	..	..	..	..	..	..	..	..
6	..	·01	..	·01	·02	·01	·01	·02	·02	..	·01	·02	..
7	..	·02	..	·01	..	..	..	..	..	..	..	..	..
8	·19	·17	·26	·13	·08	·16	·10	·18	·16	·15	·23	·25	·12
9	..	..	..	..	..	..	..	..	..	..	..	..	..
10	..	..	..	..	..	..	..	..	..	..	..	..	..
11	..	..	..	..	..	..	..	..	..	..	..	..	..
12	..	..	..	..	..	..	..	..	..	..	..	..	..
13	..	..	..	..	..	..	..	..	..	..	..	..	..
14	..	..	..	..	..	..	..	..	..	..	..	..	..
15	..	..	..	..	..	..	..	..	..	..	..	..	..
16	·16	·15	·17	·18	·14	·21	·26	·23	·31	·25	·25	·25	·23
17	..	·01	..	..	..	..	·01	..	..	..	..	..	..
18	..	..	..	..	..	..	..	..	..	..	..	..	..
19	·05	·09	·09	·03	·02	·01	·02	·04	·03	..	·02	·02	·01
20	·05	·10	·07	·08	·13	·03	·04	·05	·05	·04	·02	·04	·03
21	..	..	..	..	..	..	..	..	..	..	..	..	..
22	..	..	..	..	..	..	..	..	..	..	..	..	..
23	·08	·09	·06	·09	·10	·06	·06	·07	·07	·07	·04	·05	·04
24	..	..	..	..	..	..	..	..	..	..	..	..	..
25	..	·01	..	·01	·01	..	·01	..	..	..	..	..	..
26	·13	·09	·10	·16	·20	·20	·13	·21	·21	·22	·21	·24	·23
27	..	·02	..	..	..	..	·01	..	..	..	..	..	..
28	·13	·19	·16	·22	·16	·12	·12	·17	·20	·23	·13	·16	·22
29	·10	·10	·10	·13	·15	·12	·08	·16	·16	·14	·14	·12	·15
30	..	·03	..	·05	..	·01	·03	·01	·01	..	..	·01	..
*	·90	1·09	1·02	1·12	1·01	·93	·89	1·14	1·24	1·11	1·05	1·16	1·03
†	9·37	10·21	11·02	12·23	11·49	10·78	10·49	11·36	12·43	12·06	11·90	11·89	9·99

* The figures in this row give the totals for the month. † The totals from January 1st.

Daily Rainfall. *The 50 years (1841–90) mean at Greenwich for October is 2·81 in.* **October, 1893.**

Day of Mo.	Dorking	Reigate Hill	Caterham	Caterham Valley	Marden Park	Westerham	Coulsdon	Kenley	Purley (Reedham)	Purley (Tudor C.)	Ashtead	Oxshott	Banstead	Sutton	Wallington	Bedding-ton	Waddon	Croydon (Brim. Bn.)	Croydon Duppas H.	Croydon (Whitgift)	Croydon (Park Hill)	Croydon (Outm.Rd.)	Addington Hills	Addington (Park Fm.)	Addington (Pump. St.)	West Wickham
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·04	·04	·02	·04	..	..	·01	·02	..	·30	·03	..	·07	·03	..	..	·01	·01	·01	·01	·01	·01	..	..	..	..
2	·22	·27	·18	·22	·26	·27	·11	·14	·11	·14	·12	·15	·15	·14	·18	·17	·13	·16	·16	·16	·13	·14	·14	·19	·15	·18
3	..	..	..	..	·04	..	..	·02	..	·10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
4	..	..	·03	..	·03	·06	..	·02	..	·30	·01	..	..	..	·01	·01	·01	·02	·01	·01	..	·01	·01	..	..	·01
5	·23	·24	·25	·21	..	·29	·31	·28	·28	·34	·35	·38	·25	·27	·25	·25	·26	·26	·28	·28	·30	·30	·28	·27	·24	·15
6	·15	·03	·09	·06	·11	·10	·02	·10	·03	·04	·16	·11	·08	·10	·08	·06	·06	·06	·05	·05	·05	·03	·03	·11	·09	·12
7	·22	·20	·15	·19	·30	·30	·19	·14	·17	·40	·24	·27	·21	·17	·14	·16	·10	·15	·14	·16	·13	·14	·19	·24	·24	·28
8	..	·01	..	..	..	·04	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
9	·95	·86	·85	·84	·68	·50	·87	·90	·82	1·02	·90	·88	1·00	·97	·95	·92	·80	·91	·87	·91	·93	·92	·96	·90	·86	·97
10	·31	·18	·18	·08	·05	·10	·16	·20	·15	·12	·16	·11	·21	·17	·14	·12	·09	·10	·12	·12	·11	·12	·15	·17	·15	·07
11	·81	1·07	1·17	1·10	·90	·95	·99	·85	·74	·87	·60	·57	·77	·69	·71	·72	·74	·17	·77	·78	·80	·79	·83	·86	·91	1·70
12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
13	·06	·03	·09	·07	·07	·16	·05	·06	·03	·08	·02	·02	·02	·05	·07	·07	·08	·10	·09	·10	·09	·09	·10	·08	·06	·08
14	·02	·07	·02	·09	·01	·07	·05	·05	·04	·06	·02	..	·03	·05	·04	·04	·03	·05	·04	·05	·05	·06	·04	·05	·04	·05
15	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	·01	..	..	..	..	..	..	..
16	·18	·16	·14	·12	·17	·17	·11	·08	·07	·10	·14	·14	..	·08	·06	·06	·06	·06	·06	·03	·06	·05	·08	·05	·06	·06
17	·55	·60	·74	·49	·58	·60	·81	·80	·70	·77	·75	·65	1·04	·65	·55	·56	·55	·62	·60	·65	·71	·72	·76	·86	·82	·65
18	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
19	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	..	..
21	·10	·10	·12	·12	·11	..	·12	·12	·09	·22	·14	·14	·11	·13	·09	·11	·13	·12	·11	·05	·12	·12	·10	·10	·11	·14
22	·13	·16	·12	·14	·08	..	·09	·08	·07	·08	·10	·09	·10	·10	·12	·09	·06	[illegible]	·08	·14	·07	·06	·11	·12	·09	·08
23	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
24	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
25	·09	·05	·10	·07	·08	·10	·07	·09	·08	·08	·06	·05	..	·06	·08	·07	·06	·06	·06	·06	·06	·07	·08	·08	·07	·07
26	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
27	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
28	·02	·01	..	..	·01	·01	..	·01	·01	·01	·01	·01	..	..	..	..	..	..	·01	..	..	..	..	..	..	..
29	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
30	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
31	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
*	4·08	4·09	4·26	3·84	3·48	3·72	3·96	3·97	3·39	5·04	3·81	3·57	4·04	3·66	3·47	3·41	3·18	2·94	3·48	3·56	3·62	3·63	3·86	4·08	3·89	4·61
†	18·53	..	20·17	19·65	16·49	19·12	17·00	17·55	16·07	18·48	15·91	14·66	16·44	16·29	15·11	14·72	13·84	13·29	14·98	15·46	14·57	14·61	15·59	16·35	15·97	17·34

* The figures in this row give the totals for the month. † The totals from January 1st.

Daily Rainfall. *The 50 years (1841–90) mean at Greenwich for October is 2·81 in.* **October, 1893.**

Day of Mo.	Hayes Common	Keston (Bradfield)	Keston (Tow. Fds.)	Orpington	Farning-ham Hill	Wilming-ton	Bickley	Bromley	Beckenham	South Norwood	Wimbledon (Sew. Wks.)	Wimbledon (Mt. Ararat)	Raynes Park
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	..	..	..	·06	·01	..	..	..	..	·10	·09	·11
2	·12	·14	·15	·17	·25	·18	·10	·15	·20	·16	·14	·11	·16
3	..	·01	..	·02	..	..	..	·01	..	..	..	..	·01
4	..	·02	·03	·03	·02	·01	·01	·01	·01	..	..	..	·03
5	·26	·15	·16	·16	·21	·15	·25	·25	·27	·28	·33	·39	·45
6	·15	·09	·05	·16	·05	·15	·06	·09	·03	·10	·09	·07	·13
7	·24	·25	·20	·47	·28	·26	·18	·19	·12	·09	·19	·15	·19
8	..	..	..	..	..	..	..	·01	..	..	..	..	·01
9	·93	·91	·95	·97	·85	·74	1·04	1·03	1·08	·90	·94	1·04	1·08
10	·11	·11	·12	·07	·05	·04	·07	·08	·06	·11	·14	·15	·12
11	·83	1·07	1·01	1·03	1·15	·92	·84	·79	·68	·74	·60	·68	·60
12	..	..	..	..	..	..	..	..	..	..	..	..	..
13	·05	·05	·05	·06	·13	·22	·13	·17	·14	·12	·24	·13	·19
14	·08	·08	·10	·07	·09	·03	·07	·08	·05	·06	·06	·05	·08
15	..	..	..	..	·01	..	..	·01	..	·01	·03	..	·01
16	·04	·04	·04	·03	..	..	..	·02	·02	·05	..	·01	·03
17	·65	·64	·67	·59	·70	·81	·84	·75	·88	·76	·79	·90	·80
18	..	..	..	..	..	..	..	..	..	..	..	..	..
19	..	..	..	..	..	..	..	..	..	..	..	..	..
20	..	..	..	..	..	..	..	..	..	..	..	..	..
21	·11	·10	·06	·08	·08	·09	·08	·11	·13	·14	·14	·10	·15
22	·10	·09	·13	·08	·09	·09	·11	·10	·08	·07	·07	·13	·11
23	·01	..	..	·01	..	..	..	..	..	..	..	..	..
24	..	..	..	..	..	..	..	..	..	..	..	..	..
25	·07	·05	·06	·05	·04	·05	·06	·07	·06	·08	·08	·09	·10
26	..	..	..	..	·01	..	·01	·01	·01	·01	·03	..	·03
27	..	..	..	..	..	..	..	..	..	..	..	..	..
28	..	..	..	..	..	..	..	·01	..	..	..	..	·02
29	..	..	..	..	..	..	..	..	..	..	..	..	..
30	..	..	..	..	..	..	..	..	..	..	..	..	..
31	..	..	..	..	..	..	..	..	..	..	..	..	..
*	3·75	3·80	3·78	4·05	4·07	3·75	3·85	3·94	3·82	3·68	3·97	4·09	4·41
†	14·58	14·81	15·57	15·76	15·43	12·82	15·08	15·45	13·21	14·22	14·69	15·00	17·17

Day of Mo.	New Malden	Esher	Surbiton	Kingston	Richmond	Brixton	Wandswth. Common	West Norwood	Forest Hill Dartmh. rd.	Forest Hill (Nurseries)	Deptford	Greenwich	Eltham
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·01	..	..	..	..	·11	·07	..	..	·01	..	..	..
2	·15	·15	·15	·26	·21	·06	·11	·14	·17	·13	·10	·10	..
3	..	..	..	..	..	..	·01	..	..	..	..	..	..
4	..	·02	..	·01	·03	·01	·01	·05	·03	·04	..	·01	·03
5	·29	·23	·25	·21	·23	·32	·37	·37	·38	·32	·35	·37	·30
6	·08	·14	·08	·11	·09	·06	·08	·07	·09	·04	·06	·04	·03
7	·07	·20	·13	·16	·11	·16	·16	·17	·13	·12	·07	·09	·13
8	..	·01	..	..	..	..	·01	..	..	..	..	..	..
9	·98	1·12	1·32	1·27	1·06	1·10	1·01	1·02	1·18	1·42	1·31	1·24	·99
10	·15	·22	·19	·24	·16	·13	·16	·13	·13	·08	·08	·10	·05
11	·53	·50	·52	·60	·54	·61	·60	·68	·68	·71	·65	·68	·75
12	..	..	..	..	..	..	·01	..	..	·01	..	..	..
13	·08	·03	·05	·10	·21	·05	·21	·21	·24	·21	·17	·14	·33
14	·02	·02	·03	·03	·05	·25	·06	·07	·08	·10	·04	·05	·05
15	..	..	..	..	..	..	..	..	..	..	..	..	..
16	·02	·03	..	·01	·01	·01	·02	·02	·02	·01	..	..	..
17	·69	·57	·71	·91	·80	·75	·76	1·04	·81	·85	·94	1·04	·86
18	..	..	..	..	..	..	..	..	..	·01	..	..	..
19	..	·01	..	..	..	..	..	..	..	..	..	..	..
20	..	..	..	..	..	..	..	..	..	..	..	..	..
21	·14	·15	·14	·24	·14	·08	·15	·14	·14	·18	·11	·12	·13
22	·07	·08	·09	·01	·08	·13	·08	·08	·10	·06	·09	·09	·09
23	..	·01	..	..	..	..	..	..	..	..	..	..	..
24	..	..	..	..	..	..	..	..	..	..	..	..	..
25	·06	·05	·04	·05	·07	·07	·07	·11	·11	·13	·09	·09	·10
26	..	..	..	..	·03	..	·02	·02	..	..	..	..	..
27	..	..	..	..	..	..	..	..	..	..	..	..	..
28	..	..	..	..	..	..	..	..	..	..	..	..	..
29	..	..	..	..	..	..	..	..	..	..	..	..	..
30	..	..	..	..	..	..	..	..	..	..	..	..	..
31	..	..	..	..	..	..	..	..	..	..	..	..	..
*	3·34	3·54	3·70	4·21	3·82	3·90	3·97	4·32	4·29	4·43	4·06	4·16	3·84
†	12·71	13·75	14·72	16·44	15·31	14·68	14·46	15·68	16·72	16·49	15·96	16·05	13·83

* The figures in this row give the totals for the month. † The totals from January 1st.

Daily Rainfall. *The 50 years (1841–90) mean at Greenwich for November is 2·27 in.* **November, 1893.**

Day of Mo.	Dorking	Reigate Hill	Caterham	Caterham Valley	Marden Park	Westerham	Coulsdon	Kenley	Purley (Reedham)	Purley (Tudor C.)	Ashtead	Oxshott
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·32	·34	·35	·43	·20	·36	·21	·25	·21	·27	·28	·26
2	·09	·08	·05	·07	·05	·08	·12	·11	·07	·08	·10	·09
3	..	..	..	..	·01	..	..	·01	..	..	..	..
4	·09	·05	..	·06	·04	·04	·07	·07	·06	·10	·05	·05
5	..	·01	..	..	..	..	..	..	..	·01	..	..
6	..	·01	..	..	..	..	..	..	..	..	..	..
7	..	..	..	..	·02	..	..	·01	..	..	..	..
8	·02	·03	·10	..	·03	..	·04	·05	·03	·01	·02	·04
9	..	..	..	..	..	..	..	..	..	..	..	..
10	..	..	..	..	..	..	..	..	..	..	..	..
11	..	..	..	..	..	..	..	..	..	..	..	..
12	..	..	..	..	..	..	..	..	..	..	..	..
13	..	·01	..	..	..	..	..	·01	·01	·01	..	·01
14	·65	·64	·65	·71	·57	·62	·66	·67	·61	·73	·58	·59
15	·02	..	·02	..	·01	..	·03	·04	·03	·05	·01	·01
16	·35	·28	·35	·23	·24	·28	·24	·29	·21	·20	·19	·10
17	·13	·25	·31	·24	·26	·31	·27	·14	·11	·17	·01	·16
18	·10	·09	..	·15	·05	·10	·10	·09	·08	·14	·10	·10
19	·08	·07	·20	·19	·02	·06	·08	·03	·10	·06	·08	·09
20	..	·01	..	..	·01	·01	..	·02	..	..	..	..
21	..	·03	..	..	..	..	..	..	..	..	..	..
22	..	..	·02	..	..	..	..	..	..	..	·05	·07
23	..	..	..	..	..	..	..	..	..	·01	·01	..
24	..	..	..	..	..	..	..	·01	·01	..	..	·01
25	·30	·31	·42	·28	·18	·40	·22	·30	·23	·26	·28	·25
26	·12	·18	·18	·20	·13	·22	·14	·13	·13	·11	·08	·11
27	..	..	·01	..	..	..	..	·01	..	·03	·05	..
28	..	..	..	..	..	..	..	..	..	..	..	..
29	·08	·09	·11	·12	·06	·08	·03	·04	·02	·24	·03	..
30	·13	·16	·22	·23	·16	·18	·09	·09	·07	·10	·15	·15
*	2·48	2·64	2·99	2·91	2·04	2·74	2·30	2·37	1·98	2·58	2·07	2·09
†	21·01	....	23·16	22·56	18·53	21·86	19·30	19·92	18·05	21·06	17·98	16·75

Day of Mo.	Banstead	Sutton	Wallington	Bedding-ton	Waddon	Croydon (Brim. Bn.)	Croydon Duppas H.	Croydon (Whitgift)	Croydon (Park Hill)	Croydon (Outm.Rd.)	Addington Hills	Addington (Park Fm.)	Addington (Pump.St.)	West Wickham
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·28	·28	28	·29	·31	·28	·27	·28	·26	·27	·29	·21	·28	·24
2	·07	·08	·08	·06	·02	·06	·06	·05	·05	·04	·06	·16	·06	·13
3	..	..	..	..	..	..	..	..	..	..	..	..	..	..
4	·06	·05	·04	·03	·03	·03	·03	·03	·02	·02	·03	·05	·02	·06
5	..	..	..	..	..	..	·01	..	..	..	..	..	..	..
6	..	..	·01	..	..	..	..	·01	..	..	·02	..	·01	..
7	..	..	·01	·01	·01	..	·01	..	..	..	..	..	..	..
8	·03	·03	·03	·03	·02	·03	·03	·03	·02	·01	·02	·05	·04	·08
9	..	..	..	..	..	..	..	..	..	..	..	..	..	..
10	..	..	..	..	..	..	·01	..	..	·01	..	..	..	..
11	..	..	..	..	..	..	..	..	..	..	..	..	..	..
12	..	..	..	..	..	..	..	..	..	..	..	..	..	..
13	..	..	·01	..	..	..	·01	..	·01	·01	·01	..	..	..
14	·60	·61	·66	·64	·60	·64	·63	·63	·64	·65	·64	·70	·69	·84
15	..	·02	·03	·03	·04	·05	·05	·05	·05	·05	·07	·10	·08	·08
16	·31	·20	·21	·18	·15	·14	·17	·18	·17	·18	·20	·18	·22	·22
17	·19	·20	·20	·18	·15	·19	·16	·06	·15	·15	·17	·20	·17	·21
18	·09	·10	·17	·15	·11	·16	·13	·18	·13	·12	·12	·17	·08	·19
19	·08	·05	·06	·05	·07	·06	·05	·08	·05	·07	·04	·04	·05	·03
20	..	..	..	..	..	..	..	..	..	..	..	..	..	..
21	..	..	..	..	..	..	..	..	..	..	..	..	..	..
22	..	..	..	..	..	..	..	..	..	..	..	..	..	..
23	·01	..	..	..	..	..	..	..	..	..	..	..	..	..
24	·01	·02	..	..	·01	..	·02	·01	·01	·01	·01	·01	..	..
25	·26	·25	·26	·27	·25	·28	·26	·20	·27	·27	·29	·33	·30	·33
26	·10	·10	·13	·13	·13	·14	·13	·21	·15	·16	·15	·20	·15	·19
27	..	..	..	..	..	..	..	..	..	..	..	..	..	..
28	..	..	..	..	..	..	..	..	..	..	..	..	..	..
29	·03	·03	·02	·03	·02	·03	·02	·02	·02	·02	·03	·02	·03	·03
30	·13	·14	·14	·13	·13	·12	·14	·14	·13	·13	·12	·08	·08	·11
*	2·25	2·16	2·34	2·21	2·05	2·21	2·19	2·16	2·13	2·17	2·27	2·50	2·26	2·74
†	18·69	18·45	17·45	16·93	15·89	15·50	17·17	17·62	16·70	16·78	17·86	18·85	18·23	20·08

* The figures in this row give the totals for the month. † The totals from January 1st.

Daily Rainfall. *The 50 years (1841–90) mean at Greenwich for November is 2·27 in.* **November, 1893.**

Day of Mo.	Hayes Common	Keston (Bradfield)	Keston (Tow. Fds.)	Orpington	Farningham Hill	Wilmington	Bickley	Bromley	Beckenham	South Norwood	Wimbledon (Sew. Wks.)	Wimbledon (Mt. Ararat)	Raynes Park
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·26	·21	·21	·21	·18	·16	·23	·24	·29	·30	·28	·27	·28
2	·05	·05	·08	·03	·03	·03	·03	·05	·03	·01	·24	·07	·08
3	..	..	..	..	..	..	..	·01	..	..	..	..	..
4	..	·05	·04	..	·06	·06	·04	·05	·03	·03	·03	·03	·04
5	..	..	..	..	..	..	..	..	..	..	..	..	..
6	..	·01	..	..	·01	..	..	..	..	..	..	..	..
7	..	·01	..	..	·02	..	..	·01	..	..	..	·01	·03
8	·10	·04	·05	·04	·03	·05	..	..	·02	..	..	..	..
9	..	..	..	..	..	..	..	·01	..	..	..	..	·02
10	..	..	..	..	..	..	·03	·01	..	..	..	..	..
11	..	..	..	..	..	..	..	..	..	..	..	..	..
12	..	..	..	..	..	..	..	..	..	..	..	..	..
13	..	..	·01	·01	·01	..	..	..	..	..	..	..	..
14	·71	·84	·80	·83	·77	·72	·78	·70	·69	·62	·66	·68	·63
15	·07	·10	·10	..	·04	·07	·06	·07	·06	·04	·15	·03	·05
16	·19	·19	·20	·08	·20	·07	·12	·12	·10	·13	·06	·06	·09
17	·16	·14	·20	·18	·13	·20	·10	·14	·18	·19	·25	·25	·24
18	·14	·15	·17	·19	·12	·17	·21	·20	·12	·13	·18	·10	·21
19	·04	·03	·03	·04	·08	·05	·02	·04	·03	·11	·08	·21	·11
20	..	..	..	..	..	..	..	·01	..	·01	..	..	..
21	..	..	..	..	..	..	..	..	..	..	..	..	..
22	..	..	..	..	·04	·01	..	..	..	..	..	..	..
23	..	..	..	..	·01	..	..	..	..	..	..	..	..
24	·29	..	..	..	·02	·01	..	..	·01	·01	..	..	·01
25	·04	·24	·30	·27	·24	·30	·32	·32	·35	·29	·26	·27	·31
26	·09	·16	·15	·17	·14	·10	·13	·14	·10	·13	·10	·07	·10
27	·13	..	·01	·01	..	..	..	·01	..	..	..	..	·01
28	..	..	..	..	..	..	..	..	..	..	..	..	..
29	·02	·01	·02	·01	..	..	·01	·02	·02	·02	·01	..	·01
30	·08	·07	·06	·05	·05	·09	·14	·14	·13	·14	·12	·12	·15
*	2·37	2·30	2·43	2·12	2·18	2·09	2·22	2·29	2·16	2·16	2·42	2·17	2·37
†	16·95	17·11	18·00	17·88	17·61	14·91	17·30	17·74	15·37	16·38	17·11	17·17	19·54

Day of Mo.	New Malden	Esher	Surbiton	Kingston	Richmond	Brixton	Wandswth. Common	West Norwood	Forest Hill Dartmh.rd.	Forest Hill (Nurseries)	Deptford	Greenwich	Eltham
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·25	·24	·27	·22	·20	·28	·29	·27	·27	·26	·24	·25	·24
2	·04	·05	·06	·04	·05	·05	·04	·04	·04	·06	·02	·03	·05
3	..	..	..	..	..	..	..	..	..	..	..	..	..
4	·02	·02	·01	·02	·03	·03	·03	·03	·04	·03	·04	·05	·06
5	..	..	..	..	..	..	..	..	..	..	..	..	..
6	..	..	..	..	..	..	..	..	..	..	..	..	..
7	..	·02	..	·01	·03	·01	..	..	..	..	..	..	..
8	..	..	..	..	·01	..	..	·04	·03	·01	..	·01	·01
9	..	..	..	..	..	..	..	..	..	..	..	..	..
10	..	..	..	..	..	..	..	..	..	..	..	..	..
11	..	..	..	..	..	..	..	..	..	..	..	..	..
12	..	..	..	..	..	..	..	..	..	..	..	..	..
13	..	..	..	..	..	..	·01	..	..	..	..	..	..
14	·60	·57	·62	·75	·70	·72	·68	·66	·70	·70	·67	·67	·64
15	·02	..	..	·02	·04	·06	·06	·05	·07	·06	·02	·03	·05
16	·03	·04	·08	·06	·05	·05	·05	·10	·08	..	·04	·06	·07
17	·21	·16	·23	·23	·17	·25	·24	·20	·17	·29	·14	·13	·16
18	·10	·05	·17	·13	·19	·21	·22	·20	·16	·12	·16	·14	·14
19	·05	·03	·03	·03	·04	·11	·07	·06	·05	·04	·06	·04	·05
20	..	..	..	..	..	..	·01	..	..	..	..	..	..
21	..	..	..	..	..	..	..	..	..	..	..	..	..
22	·01	·04	·02	..	..	..	..	..	..	..	..	..	..
23	..	..	..	..	..	..	..	..	..	..	..	..	..
24	..	..	..	..	·01	..	·01	·01	·01	..	..	..	..
25	·23	·15	·26	·38	·28	·31	·29	·35	·33	·38	·30	·29	·39
26	·06	·07	·07	·01	·08	·11	·10	·10	·14	·16	·13	·11	·10
27	..	..	..	..	..	..	..	..	..	·01	..	·01	·01
28	..	..	..	..	..	..	..	..	..	..	..	..	..
29	..	·01	..	..	·01	..	·01	..	·01	..	..	..	·01
30	·09	·09	·10	·17	·13	·10	·13	·13	·15	·11	·10	·10	·10
*	1·71	1·54	1·92	2·07	2·02	2·29	2·24	2·24	2·25	2·23	1·92	1·92	2·08
†	14·42	15·29	16·64	18·51	17·33	16·97	16·70	17·92	18·97	18·72	17·88	17·97	15·91

* The figures in this row give the totals for the month. † The totals from January 1st.

Daily Rainfall. *The 50 years (1841–90) mean at Greenwich for December is 1·77 in.* **December, 1893.**

Day of Mo.	Dorking	Reigate Hill	Caterham	Caterham Valley	Marden Park	Westerham	Coulsdon	Kenley	Purley (Reedham)	Purley (Tudor C.)	Ashtead	Oxshott	Banstead	Sutton	Wallington	Bedding-ton	Waddon	Croydon (Brim. Bn.)	Croydon Duppas H.	Croydon (Whitgift)	Croydon (Park Hill)	Croydon (Outm.Rd.)	Addington Hills	Addington (Park Fm.)	Addington (Pump. St.)	West Wickham
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·03	·03	·04	..	..	..	·06	..	·06	..	·05	·04	·02	·05	·05	·05	·05	·05	·04	·04	·05	·04	·05	·08	·05	·03
2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
3	..	·01	·01	..	·03	..	..	·04	..	·02	..	..	..	..	·01	·01	·01	..	·02	..	·01	·01	·01	·01	·01	..
4	·02	..	·01	..	..	..	·03	·02	..	·03	·01	·01	..	..	·01	..	..	·02	·01	..	..	·01	·01	·01	·02	·02
5	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	·01	·01	·01	..	..	..
6	·07	·04	·10	·13	·10	·18	·08	·06	·06	·07	·05	·04	·07	·05	·04	·05	·05	·06	·04	·05	·04	·04	·04	·05	·07	·07
7	·02	·02	..	..	..	..	..	·01	·01	·02	·01	·01	·01	·03	·01	·01	..	..	·01	·01	..	..	..	..	..	..
8	·55	·43	·41	·20	·22	·30	·36	·39	·27	·28	·29	·28	·37	·23	·30	·30	·26	·29	·24	·28	·31	·28	·29	·33	·43	·32
9	..	·01	..	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	·01	·01	..	..	..	..	..	·01
10	·25	·15	·11	·12	·15	·10	·14	·19	·14	·15	·16	·16	·19	·19	·18	·19	·17	·18	·20	·21	·18	·19	·17	·20	·17	·18
11	·03	·01	·02	..	..	..	·02	·02	·02	·05	·05	·06	·03	·03	·03	·03	·06	·04	·03	·03	·02	·02	·02	·02	·01	·01
12	·60	·58	·68	·21	·44	·45	·46	·63	·37	·45	·40	·38	·52	·53	·54	·52	·46	·45	·48	·53	·50	·57	·53	·52	·55	·55
13	·40	·53	·70	·34	·47	·42	·44	·52	·36	·37	·35	·35	·34	·32	·32	·32	·33	·23	·35	·35	·36	·37	·43	·62	·52	·63
14	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	..	..
15	..	..	..	..	..	..	..	..	..	..	..	.01	..	..	..	..	..	..	·01	..	..	..	..	..	..	..
16	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
17	..	..	..	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	..	..
18	..	..	..	..	..	..	..	..	..	..	..	·02	..	..	..	..	..	..	..	..	..	..	..	..	..	..
19	·68	·43	·55	·16	·37	·50	·36	·47	·36	·45	·41	·34	·56	·57	·53	·53	·47	·44	·49	·52	·44	·50	·45	·35	·43	·51
20	·34	·42	·26	·16	·33	·45	·37	·53	·38	·37	·24	·18	·39	·35	·40	·38	·36	·35	·37	·37	·41	·39	·45	·68	·43	·45
21	..	..	·02	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	..	·01
22	·28	·24	·30	·15	·19	·25	·21	·26	·15	·15	·16	·20	·21	·15	·17	·16	·14	·16	·15	·16	·18	·18	·20	·24	·21	·21
23	..	·01	·02	·05	..	..	..	·02	..	..	..	..	..	..	..	·01	·01	·02	·01	..	..	·01	·01	·01	·01	·01
24	·15	·15	·19	·02	·08	·09	·12	·15	·08	·06	·05	·03	·11	·06	·07	·07	·06	·09	·07	·07	·07	·08	·09	·14	·10	·10
25	·02	..	..	·04	·01	·02	·02	·02	..	..	·03	·03	·02	..	·01	·01	..	·02	·01	..	..	·01	·01	..	·01	·01
26	..	..	·03	·01	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	..	..	..	..
27	..	·01	..	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	..	..
28	..	·01	..	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
29	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
30	..	·02	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	..	..
31	·05	..	·02	..	·02	..	..	·03	..	..	·03	..	..	·03	·02	·01	..	..	·01	..	..	·01	·03	..	·02	..
*	3·49	3·11	3·47	1·59	2·41	2·76	2·67	3·40	2·26	2·47	2·29	2·14	2·84	2·59	2·69	2·65	2·41	2·40	2·61	2·63	2·58	2·72	2·80	3·26	3·04	3·12
†	24·50	.. ..	26·63	24·15	20·94	24·62	21·97	23·32	20·31	23·53	20·27	18·89	21·53	21·04	20·14	19·58	18·30	17·90	19·78	20·25	19·28	19·50	20·66	22·11	21·27	23·20

* The figures in this row give the totals for the month. † The totals from January 1st.

Daily Rainfall. *The 50 years (1841–90) mean at Greenwich for December is 1·77 in.* **December, 1893.**

Day of Mo.	Hayes Common	Keston (Bradfield)	Keston (Tow. Fds.)	Orpington	Farning-ham Hill	Wilming-ton	Bickley	Bromley	Beckenham	South Norwood	Wimbledon (Sew. Wks.)	Wimbledon (Mt. Ararat)	Raynes Park	New Malden	Esher	Surbiton	Kingston	Richmond	Brixton	Wandswth. Common	West Norwood	Forest Hill Dartmh. rd.	Forest Hill (Nurseries)	Deptford	Greenwich	Eltham
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	·07	·07	·07	·05	·04	·05	·05	·05	·02	..	·05	·07	·02	·02	..	..	..	·06	·04	·03	·05	·06	·03	·03	·03
2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
3	·07	..	..	..	..	..	..	·01	·01	..	·03	..	·02	·02	·01	..	·02	·03	..	·02	·01	·01	·02	·01	..	·02
4	·03	..	·03	·02	·02	·02	·02	·02	·01	..	..	·01	·01	..	..	..	..	·01	..	·01	..	·02	..	·01	·02	·02
5	..	·02	..	..	..	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..
6	·04	·05	·07	·07	·04	·05	·05	·05	·06	·06	·04	·03	·06	·03	·05	·06	·04	·06	·02	·03	·05	·05	·05	·02	·02	·04
7	..	..	..	..	·01	..	..	·01	..	·01	·01	·01	·03	..	..	..	..	..	..	·01	·01	..	..	..	·01	..
8	·34	·27	·39	·31	·24	·20	·24	·28	·25	·24	·35	·41	·40	·33	·25	·42	·39	·43	·38	·36	·37	·28	·29	·33	·32	·27
9	..	..	..	·01	·01	..	..	·01	..	..	..	·01	·02	..	·01	..	·02	·03	·01	·03	·01	..	..	·01	..	..
10	·17	·13	·16	·13	·09	·08	·16	·16	·15	·18	·15	·13	·15	·12	·15	·15	·17	·13	·09	·13	·14	·12	·14	·07	·09	·10
11	·02	·01	·01	..	·01	..	·01	·02	·02	·02	·04	·06	·07	·06	·07	·06	·06	·06	·03	·05	·03	..	·02	·02	·02	·01
12	·62	·47	·64	·60	·48	·46	·61	·56	·45	·47	·39	·34	·43	·32	·25	·41	·45	·37	·37	·33	·42	·36	·45	·30	·37	·40
13	·47	·46	·62	·65	·32	·56	·51	·47	·37	·33	·39	·38	·42	·31	·32	·33	·38	·45	·43	·37	·40	·34	·37	·39	·37	·45
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19	·49	·42	·46	·49	·48	·44	·49	·41	·37	·45	·31	·32	·38	·26	·28	·36	·38	·28	·24	·28	·37	·25	·31	·24	·28	·27
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21	·02	..	..	..	..	..	..	..	..	..	..	..	·02	..	·02	..	..	..	..	..	..	..	..	..	·01	..
22	·15	·16	·20	·18	·15	·09	·15	·15	·14	·13	·13	·15	·16	·11	·09	·13	·16	·16	·14	·14	·14	·14	·16	·13	·16	·13
23	..	..	·01	..	..	..	..	..	·01	..	·01	·01	·03	·02	..	..	..	·01	..	·01	·01	·01	..	..	·01	..
24	·09	·09	·11	·10	·08	·02	·05	·07	·03	·05	·03	..	·05	..	·03	·04	·03	·04	·04	·03	·04	·03	·07	·02	·03	·04
25	..	·01	·01	·01	·01	·08	·02	·01	·02	·01	..	..	·01	..	·02	..	..	..	·02	·03	·02	·02	..	·08	·11	·09
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31	..	..	·03	..	·04	·04	..	·03	·02	·02	..	·01	·03	·04	·03	..	·04	..	·01	·03	·01	..	..	·01	·01	·03
*	2·93	2·58	3·45	3·02	2·46	2·39	2·76	2·75	2·29	2·30	2·11	2·15	2·64	1·80	1·71	2·13	2·35	2·30	2·25	2·13	2·33	1·93	2·29	1·90	2·12	2·22
†	19·88	19·69	21·45	20·90	20·07	17·30	20·06	20·49	17·66	18·68	19·22	19·32	22·18	16·22	17·00	18·77	20·86	19·63	19·22	18·83	20·25	20·90	21·01	19·78	20·09	18·13

* The figures in this row give the totals for the month. † The totals from January 1st.

APPENDIX III.

MONTHLY RECORDS.

Station.	Jan.	Feb.	Mar.	Apr.	May	Jun.	July	Aug.	Sep.	Oct.	Nov.	Dec.	Year.
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
Knockholt..	2·62	4.44	0·65	0·10	0·40	1·35	3·00	0·53	0·75	3·00	3·00	1·56	21·40
Warlingham	2·40	4·65	0·60	0·33	0·86	0·96	2·74	0·83	1·48	4.12	2·79	3·50	25·26
Epsom	2·40	3·61	0·56	0·17	0·96	0·96	2·02	0·33	1·82	3·90	2·20	2·31	21·24
Croydon (Waddon New Rd.)	1·63	3·06	0.42	0·06	0·63	0·78	2·30	0·52	1·11	3·24	2·05	2·27	18.07
Thornton Heath ..	1·49	3·06	0·63	0·07	0·88	0·86	2·17	0·59	1·09	3·51	1·87	1·58	17·80
Streatham Hill	1·66	2·80	0·36	0·18	0·52	0·86	2·48	0·99	1·09	4·11	2·23	1·96	19·24
Battersea ..	1·03	2·33	0·21	0.06	0·36	0·69	1·93	1·57	0·92	3·65	1·82	1·85	16·42
Forest Hill S. & W.)	1·72	2·92	0·35	0·04	0·46	1·01	3·78	1·25	1·24	4·33	2·06	1·94	21·10
Nunhead ..	1·25	2·13	0·31	0·08	0·41	0·64	2·85	1·15	0·93	3·94	1·67	1·77	17·13
Woolwich ..	1·48	2·25	0·38	0·04	0·40	0·80	2·36	1·52	1·11	3·76	2·04	1·84	17·98

APPENDIX IV.

Falls of 1·0 in. and upwards.

May 29th.

Caterham Valley, 1·03 in.; Surbiton, 1.02 in.

October 9th.

Forest Hill (Nurseries), 1·42 in.; Surbiton and Beckenham (Cedars Road), 1·32 in.; Deptford, 1·31 in.; Kingston, 1·27 in.; Greenwich, 1·24 in.; Forest Hill (Dartmouth Road) and Forest Hill (S. & V. Water Co.), 1·18 in.; Nunhead, 1·16 in.; Esher, 1·12 in.; Brixton, 1·10 in.; Beckenham (Foxgrove) and Raynes Park, 1·08 in.; Richmond, 1·06 in.; Epsom, Bickley, Wimbledon (Mount Ararat), and Battersea, 1·04 in.; Bromley, 1·03 in.; Purley (Tudor Cottages) and West Norwood, 1·02 in.; Wandsworth Common, 1·01 in.; Banstead, Bromley Common, and Woolwich, 1·00 in.

October 11th.

West Wickham, 1·70 in.; Caterham, 1·17 in.; Farningham Hill, 1·15 in.; Warlingham, 1·11 in.; Caterham Valley, 1·10 in.; Upper Gatton, 1·09 in.; Reigate Hill and Keston (Bradfield), 1·07 in.; Orpinton, 1·03 in.; Keston (Tower Fields), 1·01 in.

APPENDIX V.

January.

The month may be divided into two portions, the first fortnight being exceedingly cold and the latter part of the month very warm. The mean temperature is the lowest for January in the Wallington record, which goes back to 1885. Owing to the want of snow the frost went very deep into the ground. The lowest temperature in the shade occurred on the 5th, being 9·0° at Beddington and Waddon. The mean temperature in the shade was about 3·0° below the average, and was at Beddington 33·9°, at Waddon and Kenley 34·1°, and at Wallington 34·6°. Sunlight at Wallington was very deficient, being only 4 per cent. of the possible duration.

February.

Since 1885 it is the first time that this month has been mild, there having been seven cold Februarys in succession. It was the wettest February since 1883, and more rain fell than during the last three Februarys put together. The mean temperature was about 5·0° above the average, and was at Kenley 40·8°, at Beddington, 41·5°, and at Waddon and Wallington 41·7°. Sunlight was about the average, being at Wallington 22 per cent. of the possible duration.

March.

This was a remarkably fine month, certainly the finest since 1882, and its superior in smallness of rainfall, low relative humidity, mean daily maximum, and duration of sunshine. Had there been fewer cold nights during the latter half of the month it would have been warmer than any March since 1822. As it was, its mean was equal to that of 1842, and only 0·4° below that of 1859, being at Greenwich 0·2° higher than that of 1882. Vegetation was nearly a month earlier than 1892. The mean temperature was about 5·0° above the average, being at Beddington 45·2°, at Waddon and Kenley 45·4°, and at Wallington 46·5°. Sunlight at Wallington was 52 per cent. of the possible duration, being no less than 22 per cent. above the average.

April.

Very seldom has a finer April been recorded, and it will long be noted for its sunshine, its low relative humidity, and its small rainfall. The nights were relatively colder than the days, and owing to this the monthly mean was 0·9° below that of April, 1865—the warmest known—and 0·3° under that of 1844; but, excepting these two years, it was the warmest April at Green-

wich of this century, the mean there being 51·4°, an excess of nearly 5·0° on the seventy years' average. The mean temperature is between 5·0° and 6·0° above the average, and was at Beddington 50·8°, at Waddon 51·5°, at Kenley 51·6°, and at Wallington 52·5°. Sunlight at Wallington reached the wonderful percentage of 65, an amount never yet equalled in any month since the observations began, and this amount is no less than 28 per cent. above the average.

May.

This month was very similar to the two preceding spring months. The weather was less bright, and more rain fell than in April; but the air was drier and mean temperature slightly more in excess; it was warm throughout, the last two days being the only cool ones. At Greenwich, with the exception of May, 1833 and 1848, it was the warmest May of the century, the mean being 57·7°, nearly 5·0° above the seventy years' average, the May of 1848 being the warmest known, with an average of 59·7°. The mean temperature of the district was about 5·0° above the average, and was at Beddington 55·8°, at Waddon 56·3°, at Kenley 56·5°, and at Wallington, 57·5°. Sunlight at Wallington was 50 per cent of the possible duration, being 7 per cent. above the average.

June.

This was again a month of warm, fine, dry weather, not quite so brilliant as April or May; but notwithstanding ten or eleven cool days, it was the warmest June at Greenwich since 1868, when the mean was only 0·2° higher than this year. After a few showers on the 3rd and 6th a drought set in, which lasted until the 23rd, and during this period there was a week of intensely hot weather, the like of which has not happened in June since 1858. The mean temperature of the month was about 3·0° above the average, and was at Beddington, 60·5, at Waddon and Kenley, 60·9°, and at Wallington, 62·4°. Sunlight at Wallington was about 45 per cent. of the possible duration, being 3 per cent. above the average.

July.

This was a month of broken weather, but except on the 14th, 15th and 16th, the air was never cold, and the nights were warm, and consequently the mean of this month at Greenwich, like every other one since January, exceeded the seventy years' average, though only by 1·0°. It has been the warmest July since 1887. The mean temperature is about 1·5° above the average, and was at Beddington and Kenley 62·9°, at Wallington 63·1°, and at Waddon 63·2°. Sunlight at Wallington was only 37 per cent. of the possible duration, being 4 per cent. under the mean.

August.

The month was fine, dry, and extremely warm. After the first six days, which were cool and rather wet, hot weather set in on Bank Holiday, and continued until the 22nd. The heat during this period was greater than has ever been observed at Greenwich. For a full fortnight the maximum rose every day well over 80°, and for three days over 90°. The 18th was altogether unique, for it not only exhibited the highest temperature ever known in August (95·1°), but it was absolutely the hottest day ever known at the Royal Observatory, its mean being 79·6°, or 0·1° warmer than July 15th, 1881. The mean value for the week ending the 19th was 73·6°, and this value was for a week also the highest known at Greenwich. The last week was much cooler, but this decline in temperature only reduced its previous excess, for the month's mean at Greenwich was 65·5°, or 0·1° higher than in either 1842 or 1857, the hottest Augusts known before this year. The mean temperature of the month is about 4° above the average, and was at Kenley 63·2°, at Waddon 64·0°, at Beddington 64·7°, and at Wallington 65·4°. The duration of sunlight at Wallington was 48 per cent. of the possible duration, being 3 per cent. above the average.

September.

This was a month of most enjoyable weather, being free from the heat of the preceding months, and also free from the damp and wind usually marking the beginning of autumn. The first half of the month was dry and fine, and it was not till the end that the greater part of the rain fell. Mean temperature was about the average, being at Kenley 56·3°, at Beddington 56·6°, at Waddon 57·1°, and at Wallington 57·5°. Sunlight at Wallington was 41 per cent. of the possible duration, being a deficiency on the average of 3 per cent.

October.

The month was warm and rather wet, but withal a pleasant one. It is noticeable that the 11th and 22nd were practically the only two wet days since the beginning of March. The mean temperature was about 3° above the average, and was at Kenley 51·1°, at Wallington 51·7°, and at Waddon 52·0°. Sunlight at Wallington was 34 per cent. of the possible duration, being 1 per cent. under the average.

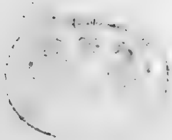
November.

This has, like several months in the present year, been rather a remarkable one. It will be noted for its low mean minimum temperature in the shade, which is the lowest in the Wallington record, which goes back to 1884, and the mean maximum in the

shade and the mean temperature are the lowest since November, 1887. The mean amount of cloud is largest, and consequently the percentage of sunlight is the lowest, for November in the Wallington record. The mean temperature is about 2° below the average, and was at Kenley 41·2°, and at both Waddon and Wallington 41·3°. Sunlight at Wallington was only 11 per cent. of the possible duration, being 8 per cent. below the average.

December.

The month, though misty and damp, has been on the whole a pleasant one, with a high mean temperature and rather a large rainfall. The mean temperature is about 3·5° above the average, and was at Kenley 39·8°, at Waddon 40·0°, and at Wallington 40·1°. Sunlight at Wallington was 19 per cent. of the possible duration, being 2 per cent. above the average.



CONTENTS.

PROCEEDINGS.

TRANSACTIONS.

Croydon Microscopical and Natural History Club.

OFFICERS FOR 1894.

Hon. Secretary.—Thos. D. Aldous, F.R.M.S., 37, St. Peter's Road, Croydon, to whom all communications may be addressed.

PROCEEDINGS & TRANSACTIONS

OF THE

CROYDON

MICROSCOPICAL & NATURAL HISTORY

CLUB.

FEBRUARY 20, 1894, TO JANUARY 15, 1895.

CROYDON:

PRINTED FOR THE CLUB, BY WEST, NEWMAN & CO., HATTON GARDEN, LONDON.

1895.

PROCEEDINGS

OF

THE CROYDON MICROSCOPICAL AND NATURAL HISTORY CLUB.

1894—95.

Twenty-fifth Annual Meeting.

Held at the Public Hall, Croydon, January 15th, 1895.

H. Franklin Parsons, M.D., F.G.S., President, in the chair.

The statement of accounts was received and adopted.

It was moved by Dr. Parsons, the President, and seconded by Dr. Hobson, and resolved, that Mr. Walter Murton Holmes be elected President for the year 1895.

Mr. R. F. Grundy was elected Secretary, Mr. E. B. Sturge Treasurer, and Mr. A. Roods Librarian.

Messrs. N. F. Robarts, J. H. Baldock, and C. H. Burnaby Sparrow were elected members of the Committee to fill the two vacancies occurring under the rules, and the vacancy caused by the retirement of Mr. W. L. Sarjeant.

The officers of the Club for the ensuing year are as follows:—

President.—W. Murton Holmes.

Vice-Presidents.—John Berney, F.R.M.S.; Philip Crowley, F.L.S., F.Z.S.; Henry S. Eaton, M.A., F.R.Met.Soc.; Henry T. Mennell, F.L.S.; Henry G. Thompson, M.D., F.R.M.S., J.P.; Edward Lovett; and H. Franklin Parsons, M.D., F.G.S.

Treasurer.—E. B. Sturge.

Hon. Secretary.—R. F. Grundy.

Librarian.—Alford Roods.

Committee.—J. H. Baldock; J. Weir Brown; H. C. Collyer; J. H. Drage; James Epps, Jun.; C. H. Goodman; H. D. Gower; N. F. Robarts; and C. H. Burnaby Sparrow.

The President then delivered his Address, at the conclusion of which a very hearty vote of thanks was accorded to him for his valuable services to the Club as President for the past year.

The President's Address.

Gentlemen,

It once more devolves upon me as your President to submit to you a retrospect of the proceedings of the Croydon Microscopical and Natural History Club during the year 1894, now ended, and in performing this duty I am pleased to congratulate the Club upon its continued satisfactory condition, although the chronicle of its doings may in some respects fall short of that of the previous year.

Our strength at the commencement of the year was 267, *viz.*, 258 ordinary members, 7 honorary members, and 2 associates. During the year 12 new ordinary members and 1 honorary member have been elected, besides the 9 elected to-night; but on the other hand 6 members have died (5 ordinary and 1 honorary), 34 have resigned (and one since the end of the year), owing to their removal from the neighbourhood or other causes, and 6 have been struck off for non-payment of subscriptions; leaving a net loss of 25. Our roll now stands at 242, *viz.*, 233 ordinary members, 7 honorary members, and 2 associates. The diminution in our numbers is to be regretted, but the withdrawal of members whose interest in the Club does not extend so far as the payment of their subscriptions is no great loss, especially as each member, in return for the 10s. due from him as a subscription, receives from the Club 6s. in money's worth, *viz.*, two tickets for the Soirée, price 2s. 6d. each, and a copy of the 'Transactions,' price 1s. Most of such members have now been weeded out, and the Club starts the year with a comparatively clean list. The number of new members elected and proposed to-night is encouraging.

A few of our losses during the past year deserve especial mention.

The death, on Sept. 30th, of our distinguished member, William Topley, F.R.S., was widely regretted, both as a loss to geologic science and on account of his amiable personal qualities. Although during his long connection of over thirty years with the Geological Survey his investigations had extended over a very wide field, the scene of his earliest and some of his best known labours was in this part of England, in the Wealden area

and its surroundings. In former years he took part in our proceedings more often than he had been able to do of late, and a paper by him is published in our 'Transactions' for 1884. At our meeting of Oct. 16th a vote of condolence with his family was passed, and I may here mention that Mrs. Topley, as a memorial of her late husband, has generously presented to the Club a valuable donation of books from his library.

Capt. Lovett Cameron, an honorary member of the Club, died during the year.

We have lost during the year, owing to his removal to Bath, the valued services of our Hon. Secretary, Mr. Aldous, who was a frequent contributor to our proceedings on microscopic subjects. During the time that Mr. Aldous's services were not available, owing to his removal from the district, and the long illness which preceded it, the duties of the secretaryship have been most efficiently discharged by our Treasurer, Mr. Sturge.

Another former Hon. Secretary, Mr. Low Sarjeant, has unfortunately been obliged to leave England during the year on account of his health. Mr. Low Sarjeant was an accomplished worker in the Photographic Section. As a mark of appreciation of his services a testimonial, consisting of a gun and accessories, was subscribed for by members of the Club, and presented to him on April 6th. Mr. Sarjeant was also, on March 20th, elected an honorary member of the Club, so that his connection with us is not entirely severed. I may add that Mr. Sarjeant has presented to the Club, a camera and stand and 273 lantern-slides.

As regards our finances. The annual Balance-sheet of our Treasurer, which is in your hands, shows that we started the year with a balance in hand of £59 10s. 3d., and concluded it with one of £30 2s. 4d., a diminution of £29 7s. 11d. The payments during the year, however, have included an item of £10 18s. 6d., belonging to the Soirée expenses of 1893, but the account for which had not been sent in at the end of that year. Allowing for this, the net diminution in our balance is £18 9s. 5d., by which amount our year's expenses have exceeded our year's receipts. On comparison of our receipts and expenditure during the past year with those of 1893, I find that our receipts in 1894 were £150 6s. against £156 14s. 6d. in the previous year, showing a falling off of £6 8s. 6d., *viz.*, £4 10s. in subscriptions, £1 13s. in sale of Soirée tickets, and 5s. 6d. in sale of 'Transactions.' On the other hand, our expenditure has increased from £159 14s. 1d. in 1893 (including the item of £10 18s. 6d. above referred to) to £168 15s. 5d. in 1894, an increase of £9 1s. 4d. The principal items of increase in the past year over 1893 were £9 18s. 10d. in printing of 'Transactions,' £2 8s. 4d. in grant

to Meteorological Sub-Committee, and £1 3s. 10d. in Soirée expenses. On the other hand, there has been a saving of £3 19s. 3d. in postage, and £1 9s. 7d. in printing and stationery. We have, I believe, at the present time no outstanding debts, and the Club is in a perfectly solvent condition: but the figures I have given show that unless we can increase our revenue by enlisting more new members we shall have to exercise care in keeping down our expenses.

The Special Fund consists of a capital sum of £210 11s. 8d. in Consols, the interest on which is to be applied to the purchase of articles and appliances foı the use of the Club. Out of it have been purchased during the year new linoleum for the floor of the Club-room (which has during the year been redecorated by the Literary and Scientific Institution, of whom we rent it), and a microscope-stand for use at the meetings of the Club. No objectives have as yet been provided, so that members wishing to exhibit slides will for the present have to bring their own (with the universal screw), but they need not bring a stand. Mr. Lovett has kindly given the Club a condenser for the illumination of opaque objects.

The pamphlets and periodicals which had accumulated during several years have been sorted by members of the Committee, and those worth preserving have been bound.

Excursions have been held as usual during the summer months. The whole-day excursions on Bank Holidays have been fairly well attended, the half-day excursions on Saturday afternoons less so, especially during July and August, when many members are probably gone farther afield. No evening rambles have been held during the past year, but perhaps the experiment is worth trying again under the auspices of the several Sub-Committees, if they would make the necessary arrangements for visits to places of interest near at hand.

The first excursion of the summer season was made on April 28th to the Zoological Gardens, Regent's Park, under the guidance of Mr. Crowley, F.L.S. The afternoon was showery. Among the creatures to which special attention was given were the weird-looking tame hornbill, which takes food out of his keeper's lips, and catches on the wing with unerring dexterity grapes thrown into the air; the secretary bird, a large Indian bird living on snakes, which it kills with a vigorous pat of its foot; in the unavoidable absence of a cobra it was induced to give a demonstration of its *modus operandi* on a dead sparrow drawn along by a string; the pelicans, who were photographed by some of the party in a race, with wings displayed and waddling gait, from their pen to the pond in which their fish had been placed; and the diving birds, who, swimming under water

by the aid of their fin-like wings, chased and never failed to catch the minnows which formed their prey; an American diver in particular, with a long slender needle-like bill, upon the point of which he transfixed the fish before catching him between the mandibles; the lepidosiren, an African air-breathing fish; the new chimpanzee; and the gibbons, who leaped and swung from point to point with more than the agility of an acrobat.

The second excursion, a whole-day one, took place on Whit Monday, May 14th, to Leith Hill, under the guidance of Mr. Sturge. The party, numbering about a dozen, arrived at Holmwood Station soon after 11, and walked thence by Coldharbour to Leith Hill. The morning was somewhat threatening at starting, but the day turned out beautifully fine. Leith Hill, which is formed by the escarpment of the Hythe beds of the Lower Greensand, here a ferruginous sand or sandstone, is the highest point in the county of Surrey, and indeed in the south-east of England, having an altitude of 987 ft. above the sea. On the summit is a tower some 50 ft. high, built in 1766 by Richard Hull, a retired Bristol merchant, who by his own desire was buried underneath it. About thirty years after its building the tower, having become a harbour for vagrants and smugglers, was closed, and the interior filled with concrete; and so effectually was the work done that when, in 1864, it was desired to reopen the tower, it was found impracticable to clear out the interior, and a staircase tower had to be built at the side to afford access to the summit. From the top twelve counties are said to be visible, and by the party, with the aid of a glass, the following points among others were made out:—The sea near Shoreham, through a gap in the South Downs at Steyning; Chanctonbury Ring, the highest point of the South Downs, and the line of downs reaching away thence past the Devil's Dyke eastward nearly to Eastbourne; Holmbush Tower, Turner's Hill, Ashdown Forest, and other parts of the Weald; the North Downs from the Hog's Back eastward to beyond Sevenoaks, and over them Croham Hurst, Shooter's Hill, the Crystal Palace, the Houses of Parliament, Hampstead, the Chiltern Hills, Windsor Forest, and Aldershot, and westward Hindhead. From the tower some of the party returned to Holmwood Station; others made their way to Dorking; while others went on through Abinger Hatch and Abinger Hammer to Gomshall Station. The day's finds were fewer than might have been anticipated. Among plants were found *Montia fontana* and *Ranunculus hederaceus*, on the wet banks of a streamlet on Coldharbour Common; the ferns *Blechnum boreale* and *Nephrodium dilatatum*, and an uncommon moss, *Bartramia pomiformis*, on Leith Hill (where also the club-moss, *Lycopodium clavatum*, formerly grew), and the wild balsam, *Impatiens fulva*, on the banks of the Tillingbourne stream at

Abinger Hammer. The soil seems favourable to conifers, the Scotch fir reaching a large size. On the top of Leith Hill are some well-grown trees of *Araucaria*, and at Abinger some tall trees of Wellingtonia (*Sequoia gigantea*), bearing round cones, small in proportion to the size of the tree. That primitive appliance for salutary punishment and warning, the village stocks, is still to be seen standing by Abinger Church.

A half-day excursion was made on Saturday, May 26th, to Ashtead, Oxshott, and Esher. The attendance was limited. Ashtead Common is a relic of forest scenery; the oaks, which are the prevailing tree, have been formerly pollarded in the exercise of the commoners' right of cutting firewood, but their limbs have now a growth of some sixty years, forming stately trees, with green ferny glades between them. Unfortunately the tender green young foliage of the oaks had been blackened and destroyed by the severe frost which occurred on the night of May 20th.* Ashtead Common being on stiff London Clay, a varied flora is not to be looked for. Ant-mounds are of unusual size and abundance. Oxshott Common is on the gravelly beds of the Lower Bagshot Sand, and is covered on the higher ground with a vegetation of heather and pine, while in the wet hollows are to be found bog-plants, such as the sundew, the dwarf willow, the petty-whin, and several species of *Sphagnum;* and in ponds the marsh St. John's-wort (*H. elodes*). On arrival at Esher the party were hospitably entertained by Mr. and Mrs. Rutland Saunders, and returned by an evening train.

On June 23rd an excursion was made to Warlingham and Worms Heath, under the guidance of Mr. Goodman, and was well attended. Ascending the hill from Upper Warlingham Station towards Warlingham Church a chalk-pit was passed, in which several of the commoner chalk-fossils were met with. Warlingham Church has recently undergone renovation and enlargement; the earliest portions of the present building date from about A.D. 1250, but it occupies the site of an earlier church, of which traces in the shape of worked stones were found in the walls of the existing building. The architectural features of interest were pointed out by Mr. Goodman, among them being an ancient fresco painting of St. Christopher. From Warlingham Church the party proceeded by Crew's Farm and Chelsham Place to Worms Heath. Worms Heath is an outlier of the Oldhaven Pebble Gravel on the chalk downs at a height of over 800 ft. above the sea. At this elevation the clouds, which had veiled the sky all the afternoon, were in contact with the ground, forming great drifting masses of vapour which obscured the view, while below their under surface the features of the valley

* 29° F. at Park Hill Rise, Croydon.

could be seen. On Worms Heath there are some old irregular conical pits, marked in the Ordnance Map as an ancient camp, but which resemble old excavations for gravel rather than military earthworks. Descending into the valley by a steep slope, and through a field of rye which overtopped their heads, the party returned by Halleloo Farm to Upper Warlingham, where tea had kindly been provided for them by Mr. and Mrs. Goodman. Among the botanical finds of the day were the bee-orchis, the grass-leaved vetch (*Lathyrus Nissolia*), the white mullein (*Verbascum Lychnitis*), *Cephalanthera grandiflora*, &c.

On July 21st a half-day excursion, photographic and general, had been arranged to Hayes and Keston Common, but your President was the only member who attended, and his proceedings hardly need to be chronicled. Several interesting plants, as the arrow-head, the sundew, butterwort, and bog asphodel, *Carduus pratensis*, *Verbascum Lychnitis*, *Scirpus fluitans*, and *Geranium lucidum*, were seen on Keston Common.

On Bank Holiday, Aug. 6th, a whole-day excursion was made to Haslemere and Hindhead, and there was a fair attendance, especially considering the long railway journey, and the unpromising weather in the early part of the day. Fortunately, however, a dull damp morning was followed by a brilliantly fine afternoon. On arriving at Haslemere, a little after 11, the party, under the guidance of Mr. Mennell, jun., after stopping to look at the picturesque little church, and Mr. T. P. Newman's alpine garden, well stocked with hardy perennials and rock-plants, proceeded to Hindhead up the wooded spur called Hurt-hill Copse, probably from the abundance of whortleberries or "hurts" which grow there. In these woods was found the rare and curious fungus, *Cynophallus caninus*, so called from its remarkable resemblance to the penis of a dog; it lacks, however, the fœtid odour so characteristic of its commoner ally, *Phallus impudicus*. Hindhead is a lofty hill, or range of hills, 895 ft. in altitude at its height-point, on the western border of Surrey adjoining Hampshire. It is formed, like Leith Hill, Tilburstow Hill, and the other hills of the range which immediately borders upon the Weald, by the outcrop of the hard Hythe beds of the Lower Greensand. At this point, however, the outcrop of these beds bends southward to form the western boundary of the Weald; so that the strike is N. and S., and the dip westerly. In consequence the range, unlike most others in England, has a steep escarpment on the east and a more gradual dip to the west. On the highest point of the hill a memorial stone, inscribed with appropriate sentences, marks the site of the gibbet on which in former days highwaymen expiated their crimes. Immediately to the north of this is the "Devil's Punch-bowl," a deep semicircular amphitheatre-like hollow, the upper end of a steep valley

running northward parallel with the main ridge of the hill. At the bottom of this valley is a patch of boggy ground, kept saturated by springs issuing from the base of the Hythe beds where these rest on the subjacent Atherfield Clay. Here were found several interesting bog-plants, as two species of sundew, viz., *Drosera rotundifolia* and *D. intermedia*; the bog asphodel, gay in flower; the bog pimpernel (*Anagallis tenella*); and the ivy-leaved campanula (*C. hederacea*); also several species of ferns. From the summit of the hill a fine view was obtained, though hardly so panoramic as that from Leith Hill. The way back to the station led through sandy lanes between deep banks.

A half-day excursion, on Aug. 18th, to Chislehurst and St. Paul's Cray Common, was announced, but so far as I am aware not even a quorum of one member was obtained.

On Sept. 15th a half-day excursion for the especial purpose of a fungus hunt was made, by kind permission of Col. Warde, to Squerryes Park and Crockham Hill. The party, of whom some had walked from Oxted Station, and others had come by train to Westerham, met at the Westerham entrance by a picturesque overshot water-mill, now used for pumping purposes by the Kent Waterworks Co. They then walked through the beautiful undulating and well-timbered park to Crockham Hill and Kent Hatch, returning by Limpsfield Common to Oxted Station. Nearly forty species of fungi were found and identified, among the less common being *Cantharellus cinereus*, *Hygrophorus calyptræformis*, and *Craterellus cornucopioides*. The last named was plentiful on the bare soil in beech-groves, though its blackish irregular pilei were little conspicuous against the dark soil, an instance of resemblance in hue between a fungus and its habitat. The purpose subserved by the often bright colours of fungi, whether protective or attractive, is an unsettled question. One can hardly suppose these colours to be without any use, but what their use to the plant may be is not known. The fungi collected on this day were exhibited at the evening meeting on Sept. 18th.

Since our last annual meeting eight ordinary evening meetings of the Club have been held, *viz.*, on the third Tuesdays in February, March, April, May, September, October, November, and December. I am glad to say that there has been no difficulty in maintaining a supply of communications for these meetings; all with one exception, which was not the sole paper of the evening, having been from members of the Club. We gladly and gratefully accept the help of friends from outside, but it is satisfactory that the Club is able to keep up its meetings without external aid. We should be glad, however, to see more of our members, especially the younger ones, taking an active

part in the proceedings of the Club. The attendance at our ordinary meetings has varied, but on the whole has been moderately good; better, I think, than in the previous year. At the meetings on May 17th, Oct. 16th, and Dec. 8th lady visitors were present on the invitation of the Club.

At the meeting of Feb. 20th the Report of the Meteorological Sub-Committee for 1893 was read on behalf of the Hon. Secretary, Mr. F. C. Bayard. This Report was published in our volume of 'Transactions' for that year (Trans., Art. 115, p. 90). The main feature of the year 1893 was the deficiency of rainfall which marked nearly every month, especially in the earlier part of the year, and which amounted at Greenwich to 4½ in. below the average of the preceding fifty years. The temperature of nearly every month, with the exception of January and November, had been above the average, and so had also in most months been the duration of sunlight. The President remarked that the temperature of the ground at a depth of 4 ft. was 3° F. higher in January and February, 1894, than in the corresponding season of 1893. This was no doubt due to the excess of heat received during the previous year, and it accounted for the early growth of vegetation, which was so marked a feature of the spring of 1894.

Mr. Straker read a paper entitled "Some Notes on the Outer Shetlands," in which he described the scenery, geology, botany, and animal life of these the northernmost of the British Islands, referring especially to Unst, Foula, and Fair Isle. He showed how in the native art of the latter island the influence of the survivors of the Spanish Armada, who were shipwrecked there in 1587, could be traced. The paper was illustrated by botanical specimens, stuffed birds, and other objects of interest; and, in further illustration, a specimen of the now almost extinct great skua was exhibited by Mr. Weir Brown; and copper cruzies and specimens of stormy petrels used as lamps in Shetland were shown by Mr. Lovett.

On March 20th Mr. Aldous showed some recent improvements in the microscope for high-power work, especially a centering substage, and a graduated draw-tube.

A paper was read by Dr. Hobson on "Some Points in the Life-history of Bacteria," in which he treated of the botanical position, morphological characters, movements, methods of reproduction by fission and by spore-formation, and habitats of these lowly plants, of the chemical processes involved in their growth, and of the method of their identification by cultivation. The paper was profusely illustrated by lantern-slides, kindly lent by Dr. E. Klein, F.R.S. It will be published in our 'Transactions' (Trans., Art. 116).

The meeting on April 17th was devoted to the exhibition of specimens and remarks thereon. Your President exhibited, as

an illustration of the unusual forwardness of the spring, a specimen of hawthorn in flower, gathered at Slaugham, Sussex, on April 15th. (It was in flower at Croydon a few days later.) He had never but once before seen it in flower so early as the end of April, and it was not generally out until nearly the middle of May.

Mr. J. Epps exhibited and described the fruit of the "Cape gooseberry" (*Physalis peruviana*), which the members had the opportunity of tasting.

Mr. W. C. Brown exhibited the disarticulated bones of the head of the pike (*Esox lucius*).

Mr. Goodman gave a demonstration of the anatomy of the wings of insects.

Mr. Murton Holmes exhibited specimens of nudibranchiate mollusca and other marine animals.

Mr. Mennell exhibited *Viola arenaria* in flower from Teesdale, its only British locality.

At the meeting on May 15th Mr. Drage exhibited a specimen of the giant hemlock (*Heracleum giganteum*); also cones of the Wellingtonia (*Sequoia gigantea*), found at Abinger on the excursion of the previous day.

Mr. Mennell exhibited two rare plants, viz., *Cephalanthera ensifolia* and *Hutchinsia petræa*, which he had found a few days previously at Symonds Yat on the Wye.

Mr. Lovett read an interesting paper on "Notes from Cashmere and Northern India," which was illustrated by a series of well-executed water-colour drawings made by his brother, Captain Lovett, and by a large collection of native-made objects. These comprised tinder-boxes of both the Hindoo and Mongolian types, and also a fire-drill used by the aboriginal Bhîls, and pipes in a variety of forms; the simplest consisted merely of mud on the river-bank, raised up into a small mound; a cavity in the summit of the mound contained the burning leaves, and a smaller hole driven in obliquely formed the stem, by lying down and applying the mouth to which the smoke was inhaled. There were ancient and curious lamps, and small vessels of sun-dried clay, containing charcoal, and used as cooking-stoves on native house-boats; also native needlework, and a Sikh polo-stick, the game of polo having come to us from that athletic people.

The meeting on Sept. 18th was also devoted to the exhibition of specimens. Mr. H. C. Collyer exhibited some bones and articles taken from a supposed Saxon grave on the Sussex downs in the neighbourhood of Arundel, among them being a skull deeply cloven by a clean cut as of a sword, probably that of a man killed in battle; the bones indicated a height of about 6 ft. 3 in.

Mr. Lovett exhibited a pair of "rivelins," or leathern shoes of primitive pattern, from Fair Isle, Shetland; also a model of a coracle, or portable wicker-boat, used for fishing on the Welsh

rivers, and made some remarks on the ancient character of these objects.

Mr. Goodman exhibited some beautifully-executed drawings of microscopic fungi.

Mr. Mennell exhibited some dried plants from Switzerland, among which were two orchids, *Epipogium Gmelini* and *Cephalanthera rubra*, which have been found as very rare natives of Britain.

Your President exhibited specimens of several rare British plants grown in his garden, *viz.*, the shepherd's-staff or small teasel (*Dipsacus pilosus*), from Arundel; *Senecio saracenicus*, from Somerset; and two species of balsam naturalised in Surrey, *viz.*, *Impatiens parviflora*, from Oxted, and *I. fulva*, from the banks of the Tillingbourne at Abinger. The latter was the plant referred to in the last Presidential Address as *Impatiens Noli-me-tangere*, which was, I find, an error.* In my garden at Croydon it does not produce the normal petalled flowers, but bears seed abundantly, like the wood-sorrel and some of the violets, from minute inconspicuous petal-less flowers. Its congener, *I. parviflora*, seems not to possess this habit, which also is not shared by all the species of *Oxalis* and *Viola*.

The fungi which had been gathered at Squerryes Park at the excursion on the previous Saturday were also exhibited, and your President gave a brief account of the botanical characters of this group of plants.

On Oct. 16th a lecture was given by Mr. Lovett on "Primitive Lighting Appliances." Beginning with the crudest appliances, such as a whelk-shell containing oil, the beak of the shell serving to hold the wick, or a stone hollowed into a cup-shaped cavity for the oil, with a groove in which the wick lay, he traced the development of the oil-lamp through successive stages to its modern form. An important improvement upon the simplest forms was to add a vessel under the lamp to catch the redundant oil dripping from the wick. This stage is represented by the "cruzy" still in use in the north of Scotland, and met with under various forms and modifications in many parts of the world. It consists of two beaked saucers of metal, one above the other, the upper containing the oil and wick, and the lower receiving the drip; the upper saucer can be tilted forward to supply the wick when the oil gets low. In a further stage the beak becomes a spout. Other modifications were the covering of the oil-vessel by a lid, and the holding of the wick in a carrier, and this being removed from the side to the centre of the oil-vessel, we had the origin of the modern oil-lamp. The glass chimney and Argand burner were improvements added in the last century. The lecture was illustrated by excellent lantern-slides of lamps in Mr. Lovett's collection, from photographs by

* see p. xxv

Mr. Kenneth McKean. In conveying the thanks of the meeting to Mr. Lovett for his excellent address, your President alluded to the still more recent improvements in lamps, *e.g.*, duplex and regenerative burners, pointing out that these proceeded on the lines of increasing the temperature of the flame, since the hotter the flame the larger was the proportion of the energy transformed into light as compared with that wasted as dark heat.

At the meeting on Nov. 20th, Mr. Wm. Whitaker, F.R.S., of the Geological Survey, submitted to the Club a series of records of well-borings in Surrey, which will be published in our 'Transactions' (Trans., Art. 117). He made some remarks upon certain of the sections, especially upon that at East Horsley, which had pierced the whole thickness of the chalk, here considerably greater than is usual in the London area; and upon the well at Richmond, where a fair quantity of water was obtained from galleries driven in the chalk beneath the Tertiary beds, one of these galleries having, in fact, reached the base of the Thanet Sand from below.

Mr. A. Lucas exhibited seed-vessels of *Arum Dracunculus.*

The President showed *Nostoc commune* (from Riddlesdown), a gelatinous alga, which appears suddenly in masses on calcareous soil after heavy rain; also a fossil lobster (*Thenops scyllariformis*) found by Mr. C. Hehner in the Park Hill railway-cutting.

The President read a paper entitled "Habits and Habitats of Plants; some Remarks on Superficial Resemblances between Plants of Different Affinities," in which he pointed out how plants belonging to widely different orders, but adapting themselves to similar modes of life, had undergone modification on parallel lines. This was exemplified by reference to leafless root-parasites, to the plants with quill-like leaves which grow on the gravelly bottoms of mountain lakes, to the plants which grow submerged in water and to those which float on the surface, and to twining, climbing, succulent, bulbous, and alpine plants. Dried specimens of the plants referred to were shown in illustration. (This paper is published in the 'Transactions,' Art. 118.)

On Dec. 18th Mr. Murton Holmes read a paper on "The Nutrition of Plants." He first described the cell-structure and nutritive processes in ordinary green plants, and then spoke of the special processes of nutrition in certain groups of plants, as saprophytes, carnivorous plants, parasites, and plants which live together in mutually beneficial association (symbiosis). The paper was illustrated by some excellent diagrams, and by microscopic slides exhibited by several members; and was followed by discussion. (It is published in the 'Transactions,' Art. 119.)

Besides the ordinary meetings of the Club, a lecture, on April 3rd, by the Rev. H. N. Hutchinson, B.A., F.G.S., was kindly

arranged for by our Vice-President, Mr. Philip Crowley. The lecture was given in the large Public Hall, and there was an attendance of about 300. The subject of the lecture was "Extinct Monsters," and it included mention of sea-scorpions (*Pterygotus*), from the Old Red Sandstone; of the great fish-lizards (*Ichthyosauria*), long-necked sea-lizards (*Plesiosauria*), and flying dragons (*Pterodactyla*); of the *Dinosauria*, huge land-reptiles of a kangaroo-like shape, which form with the ostriches a link between reptiles and birds; of the sea-serpents of the chalk (*Mosasaurus*); of the ancient mammals of generalised type discovered by Prof. Marsh in the American Tertiaries; of Indian monsters from the Siwâlik Hills; of the giant sloths and armadilloes of South America; of the mammoth, contemporary with early man, and still occasionally found in the flesh embedded in the frozen soil of Siberia; of the woolly rhinoceros; of the giant birds of New Zealand; and of the comparatively recently extinct sirenian, Steller's sea-cow. The lecture was illustrated by about fifty lantern-slides, representing these extinct forms of life.

The Twenty-fifth Annual Soirée of the Club was held at the Public Hall, on Nov. 28th. The attendance was 174 members and exhibitors and 368 visitors, making a total of 542, against 567 last year, and there was consequently a slight falling off in the receipts. Though the attendance thus showed a slight diminution, there was no falling off in the number and interest of the exhibits, which, so far as my memory serves me, quite came up to any former occasion. Among the principal exhibits were Bellarmine pottery and coins found in the recent excavations in High Street, and other antiquities, lent by the Corporation of Croydon; a very extensive collection of British birds' nests and eggs, by Mr. P. Crowley; a large group of stuffed birds, skins, &c., by Mr. C. Thorpe; a very interesting collection of obsolete and primitive household appliances, by Mr. E. Lovett; a collection of antique candle-snuffers of various design and curious contrivance, by Mr. E. Bidwell; Japanese art-bronzes, by Mr. Alfred Parsons; a large collection of cultivations of chromogenic and pathogenic bacteria, by Dr. F. R. Blaxall; cultivations of bacteria from sewage, by Dr. J. M. Hobson; beautifully dried specimens of British plants, by Mr. C. E. Salmon; an ancient jewel-casket, by Mr. H. C. Thompson; insects, by Mr. C. H. Goodman; minerals, by various exhibitors; and a collection of British fossils, by your President. The annual bouquet of flowers gathered in the open air at Addiscombe that morning contained about 138 different species and varieties, as against 113 last year and in 1892, 140 in 1891, and 121 in 1890. November, 1893, was one of the few cold months of a warm year, whereas November, 1894, was warm after a cold

summer; hence our number of plants in flower exceeded that of the previous year, although the Soirée fell nearly a week later. The collection of fungi from the neighbourhood of Croydon contained 33 kinds, against 28 in 1893 and 38 in 1892. There was a fair array of microscopes brought by members of the Royal, Quekett, South London, and Holmesdale Societies and other friends, as well as by our own members. Among the more novel microscopic objects exhibited may be mentioned:—Bacilli of bubonic plague (from Hong Kong), and of vaccine lymph, by Dr. Monckton Copeman; *Conochilus volvox* (an infusorium living in colonies, like a number of Vorticellæ with their stalks tied together instead of being attached to a fixed object), by R. C. Crossland; *Plumatella* and *Eudendrum*, by Dr. Bossy; *Lucernaria auricula* (a hydrozoon in the medusa stage), and Cape diamonds and garnets, by G. Berry; platino-cyanide of yttrium (with polarised light), by H. G. Coomb. The favourite exhibits of the circulation in a frog's foot and of the face of a watch multiplied by the facets of a beetle's eye (the latter shown by Mr. J. Epps, jun.), did not fail to attract the usual amount of interest.

The work of the Photographic Section was displayed in the corridor and on screens, as well as by exhibitions of lantern-slides, during the course of the evening.

The Club were indebted as usual to Mr. Berney, Mr. Crowley, and Mr. Sturge for their valuable help in making the necessary arrangements.

The conversational meetings, which should be held on the last Wednesday in each month during the session under the auspices of the several Sub-Committees alternately, have rather flagged during the year; few have been held, and those few have been ill-attended. The Friday evening meetings of the Photographic Section have, however, been kept up.

Concerning the sectional work of the Club only the Meteorological and Photographic Sections have sent me reports. From the Meteorological Section I receive the following statement of their work in 1894:—

The Meteorological Sub-Committee has continued its work under the supervision of its Honorary Secretary. The daily rainfall of 66 stations in the Club District has been tabulated every month, examined and corrected, and the results printed and issued to the observers, and all members of the Club interested in the question, either before or within a few days after the end of the month succeeding that to which the statistics refer. Short particulars of the weather have also been inserted in each monthly sheet. Three gentlemen interested in the work of the Section contributed a sum of £15 towards the expenses.—F. Campbell Bayard, *Hon. Sec.*

I may here note that during the past year a change has been made in the form of the monthly sheet issued to rainfall observers, the notes on the meteorological, phenological, and other features of the month being appended to each monthly sheet, instead of being given, as in former years, as an appendix to the annual report of the Section. It is thought that these notes may be of more interest to observers when the facts are still fresh in their memory than at the end of the year. They will still be included in the annual report of the Section, which will be presented at our February meeting.

There is plenty of scope for more phenological observations as a branch of the work of the Club. Observations as to the date of occurrence of well-marked periodical phenomena, such as the flowering of plants, the arrival of migratory birds, &c., if carried out on a sufficiently extended scale, are of interest, both as indicating the character of the seasons in different years and the climate of different places.

Of the work of the Photographic Section, Mr. Gower gives me the following report:—

In tendering my report for the past year, I am glad to say that the Photographic Section of the Club have again passed through a very successful season. One thing, however, I am sorry to have to regret, and that is the half-hearted way in which the excursions have been attended. Numerous excursions were arranged, but members failed to put in an appearance at many of them. If the Excursion Committee which was formed last year would look up the ground beforehand, I do not think such scant attention would be paid to the excursions as there has been during the past season.

Technical conversational meetings and lantern nights have been held as usual.

A marked improvement took place this year at the Soirée with reference to the pictures, nearly all exhibits being sent in framed, the work being good all round (many of the exhibits giving evidence of individual rambles other than those excursions arranged by the Club). Some 600 transparencies occupied the Small Hall, and during the evening three lantern exhibitions of members' work were given in the School of Art Room.

The membership of the Section remains the same. Several resignations have taken place, but have been filled up with new-comers.—HARRY D. GOWER, *Hon. Sec.*

May I be permitted to suggest that the sectional Sub-Committees appear to require some strengthening. I am inclined to think that in some cases the same member would be useful on more than one Sub-Committee, and also that there might be advantage in forming a Sub-Committee for Archæology and Anthropology, as suggested by me last year.

Mr. Cushing, who was appointed our delegate at the Annual Meeting of the British Association at Oxford, in August, 1894, gives me the following account of the proceedings of the conferences of the delegates of corresponding societies held in connection with that meeting:—

British Association Meeting at Oxford, 1894.

During the meeting of the British Association at Oxford in August last there were two conferences of delegates representing various corresponding societies from all parts of the United Kingdom, and of which the Croydon Microscopical and Natural History Club was one. At the first conference, held on Aug. 9th, an instructive and exhaustive paper was read by Mr. Cuthbert Peek on Local Museums, with suggestions for their management and improvement. The principal points raised and discussed were on "Methods of registration and cataloguing; the protection of specimens from injury and dust; the circulation of specimens and type-collections for educational purposes; central referees for nomenclature and classification; the most satisfactory methods of making museums attractive; museum lectures and demonstrations; and the relations between museums and County Councils." The subject was most ably treated by Mr. Peek under all the above headings, and much useful information was given both in the paper itself and in the subsequent discussion; but throughout the proceedings there seemed to be no points of special value to us in Croydon at the present time, as in all cases it was assumed, *à priori*, that a museum was already in existence, which unfortunately is not the case here. The information obtained, however, may be useful to us at some future time, should it ever be the good fortune of the burgesses of Croydon to successfully impress upon the municipal authorities the necessity of establishing a museum and an art gallery on a similar basis to the Public Library, already so successfully established and appreciated; as it seems to me that there is no satisfactory way of ensuring the proper care and exhibition of specimens and collections and the permanence of a museum, however well one might be started by private munificence, otherwise than by its establishment by the local County Council.

While on this subject, I should like to place on record the opinion that I think there is reason to believe that in the past Croydon has lost some valuable collections which might have remained here and enriched a local museum had there been a well-equipped institution in which they could have been deposited and cared for, and there is no doubt that if such a museum were once established it would soon attract valuable contributions from many sources. It therefore becomes a question whether, in the near future, the Committee of the Croydon Microscopical and Natural History Club might not consider it desirable to approach the Croydon County Council on the subject. Until something of this kind is done, and a permanent museum is established, I see no way of making any use of the valuable suggestions afforded by the reading and discussion of Mr. Cuthbert Peek's most interesting paper.

The second conference was held on Aug. 14th, when various subjects were brought up for discussion, such as meteorological and

geological photographs, earth tremors, pollution of the air of towns, ethnographical surveys, erratic blocks, &c.; but as I was unable to be present at this meeting, I would refer you to the Report published by the Corresponding Societies Committee for an account of the discussion of the interesting topics brought under the notice of the conference.

THOS. CUSHING.

We should all, no doubt, be ready to echo Mr. Cushing's wish that in the new municipal buildings now being erected space could be found for a local and educational museum worthy of a town of the size of Croydon. The reasons why Croydon has not such a museum as many much smaller provincial towns have are probably that, though an old town, its municipal life is but young, and that proximity to London and the national museums there renders the want of a local museum less felt.

And now, Gentlemen, it only remains for me to thank you for your kind support during my two years of office, and to bespeak a continuance of the same for my successor who is so worthily to occupy the Presidential chair.

Sub-Committees.

The members of the following Sub-Committees will, at all times, be glad to receive notice of, and to investigate, any facts of interest connected with the Natural History of the district, and to give to members of the Club any advice and assistance in their power.

Botanical Sub-Committee.—JAMES EPPS, F.L.S., Norfolk House, Beulah Hill, Upper Norwood; W. INGRAMS, Whitgift Schools, Church Road; H. T. MENNELL, F.L.S. (Hon. Sec.), Park Hill Rise; H. FRANKLIN PARSONS, M.D., F.G.S., 4, Park Hill Rise; ERNEST STRAKER, Richmond, Malden Road, Wallington.

Geological Sub-Committee. — JAMES CHISHOLM, Addiscombe Lodge; GEORGE HINDE, Ph.D., F.G.S. (Hon. Sec.), Avondale Road; J. M. HOBSON, M.D., 65, Lower Addiscombe Road; H. FRANKLIN PARSONS, M.D., F.G.S., 4, Park Hill Rise; N. F. ROBARTS, F.G.S., Addiscombe Grove; T. WALKER, C.E., Warrington Road.

Meteorological Sub-Committee.—F. C. BAYARD, LL.M. (Hon. Sec.), Wallington; THOS. CUSHING, F.R.A.S., Chepstow Road; BALDWIN LATHAM, C.E., Duppas House, Croydon.

Microscopical Sub-Committee.—T. A. DUKES, M.B., B.Sc., 16, Wellesley Road; H. GREENWAY, Ashburton Road; J. W. HELPS, 3, Tavistock Road; E. LOVETT, 41, Outram Road; W. MURTON HOLMES (Hon. Sec.), Glenside, St. Peter's Road; E. B. STURGE, The Waldrons.

Photographic Sub-Committee.—J. WEIR BROWN, Heathfield Road; J. H. BALDOCK, F.C.S. (Lanternist and Recorder), St. Leonard's

Road; H. D. Gower (Hon. Sec.), 16, Wandle Road; C. F. Oakley, Sudbury Road, Thornton Heath; Alfred Roods, 15, St. James's Park; C. H. Burnaby Sparrow, 1, Chepstow Road.

Zoological Sub-Committee.—John Berney, F.R.M.S. (Hon. Sec.), Chatsworth Road; Philip Crowley, F.Z.S., F.L.S., Waddon; John Henry Drage, Tamworth Road, Croydon; C. H. Goodman, Bryn Cottage, Whyteleaf, Surrey; H. Lee, St. John's Grove; R. McLachlan, F.R.S., F.L.S., 23, Clarendon Road, Lewisham.

Anthropological Sub-Committee.—H. C. Collyer, Homewood, Haling Park Road; E. Lovett (Hon. Sec.), 41, Outram Road; N. F. Robarts, F.G.S., Abingdon, Addiscombe Grove; H. G. Thompson, M.D., 86, Lower Addiscombe Road.

The President, Vice-Presidents, and Hon. Secretary of the Club for the time being are *ex-officio* members of every Sub-Committee.

Members elected, 1894.

January 16*th.*—Edmund Dean, LL.B., 28, Oliver Grove, South Norwood. Nathaniel F. Robarts, F.G.S., Abingdon, Addiscombe Grove, Croydon.

March 20*th.*—George Edward Neeves, Cromer Lodge, Birdhurst Road, Croydon. Henry W. Perry, The Cedars, London Road, Croydon.

April 17*th.*—Henry Dolling Smith, 19, Cedars Road, Beckenham, Kent.

October 16*th.*—Wm. J. Lancelot Smith, Sydenham.

November 20*th.*—Matthew Curry, Jun., M. Inst. C.E., Como Lodge, 62, Coombe Road, Croydon. Henry C. Thompson, "Horndean," Waddon.

December 18*th.*—Major Frederick Carr Swinerton Dyer, Kenley, Surrey. Alexander Fitzgerald, 93, Addiscombe Road. Walter Charles Norton, Maycourt, Campden Road. David Hill, Beckenham.

Exhibits, 1894.

February 20*th.*—T. D. Aldous (under the microscope), Slides of the two common Moulds, *Penicillium* and *Aspergillus glaucus*, stained and mounted in balsam, showing spores *in situ*.

March 20*th.*—E. Lovett, A series of photographs of the horse-chestnut in bud, showing its mode of development.

April 17*th.*—H. F. Parsons, A piece of hawthorn in flower, gathered at Slaugham, in Sussex, on April 15th, and *Primula farinosa*. J. Epps, Jun., The fruit of the Cape gooseberry, *Physalis Peruviana*. W. Murton Holmes, Nudibranchiate molluscs and an annelid. H. T. Mennell, *Viola arenaria*, a scarce plant from Teesdale. W. C. Brown, The bones in the head of the pike (*Esox lucius*), disarticulated.

May 15*th.*—J. H. Drage, A large leaf of the giant parsnip (*Heracleum giganteum*), and some cones of the *Sequoia gigantea*, found at Abinger. H. T. Mennell, *Cephalanthera ensifolia*, found in the vicinity of Symonds Yat, on the Wye. E. B. Sturge, Weevils, bugs, beetles, and a small cockchafer from Nîmes; and some olive-leaves under the microscope.

September 18*th.*—H. C. Collyer, Some bones and a skull taken from a supposed Saxon grave on the downs near Arundel. E. Lovett, A pair of rivelins or shoes, brought from Fair Isle by Mr. Straker; and a model of a coracle used on Welsh rivers. C. H. Goodman, Drawings of microscopical fungi. H. T. Mennell, Dried plants from Switzerland, including two orchids, *Epipogum Gmelini*, parasitic on the roots of pine-trees, and *Cephalanthera rubra*. H. F. Parsons and W. Murton Holmes, A large collection of fungi from Squerryes Park, near Westerham. H. F. Parsons, The shepherd's staff, a small teasel (*Dipsacus pilosus*), from Arundel; ragwort (*Senecio saracenicus*), from Somerset; and two species of balsam naturalised in Surrey, viz., *Impatiens parviflora*, from Oxted, and *I. fulva*, from Abinger; all grown in his garden.

November 20*th.*—A. Lucas, Fruit of *Arum dracunculus* (Snake *Arum*). H. F. Parsons, A gelatinous alga, *Nostoc commune*, from Riddlesdown. C. Hehner, A fossil lobster (*Thenops scyllariformis*) and some shark's teeth from the railway-cuttings in Park Hill, and a fossil-bone of ox found in the elephant-beds, Brighton.

December 18*th.*—C. H. Goodman, Galls formed on twigs of the aspen found on Wimbledon Common.

Library.

The additions to the Library during 1894 are as follows :—

From Individuals. — A. Bennett: Botanical pamphlets; F. C. Bayard: Report of the Meteorological Council, appendix xv.; A. Barber: Various photographic year-books and almanacs; H. D. Gower: The photographic papers as issued; W. Low Sarjeant: A 15 in. × 12 in. camera and stand and collection of 293 lantern-slides; E. B. Sturge: Peruvian-bark, by C. R. Markham; Mrs. Topley: British petrography (Teall); Memoirs of the late H. E. Strickland, M.A.; Report of the Museums Association for 1893; Manual of the Protozoa (J. R. Greene); Manual of the Cœlenterata (J. R. Greene); Observations on the disposition of the cubital coverts in birds (J. G. Goodchild); The inadequacy of Natural Selection (Spencer); The probability of finding coal in the South-east of England (W. Taylor); A large number of pamphlets and reprints of papers on Anthropology, Climate, Deneholes, Geology, &c.

From Societies.—Journal of the Société Belge de Microscopie for 1894; British Association Reports, 1893; Berwickshire Naturalists' Club Proceedings, 1892; Annals de Sciencias Naturaes, Portugal; Epsom College Natural History Society, Journal, 1893; Essex Naturalist, 1893; East Kent Natural History Society, 1893; Eastbourne Natural History Society, 1892—93; Hants Field Club, vol. ii., parts 2 and 3; Manchester Microscopical Society, 1893; Manchester Geographical Society, vol. viii., parts 7 to 12; vol. ix., parts 7 to 9; vol. x., parts 1 to 3; Northamptonshire Natural History Society, 1893; Norfolk and Norwich Naturalists' Society, vol. v., parts 1 to 5; Quekett Microscopical Society, 2 part, 1894; Reading Literary and Scientific Society, 1894; Royal Microscopical Society, 1894; Scottish Microscopical Society, 1893—94; South London Entomological and Natural History Society, 1892—93; West Kent Natural History, Microscopical, and Photographic Society, 1893—94.

Croydon Microscopical and Natural History Club.—Balance-sheet for the Year ending 31st December, 1894.

Receipts.

	£	s.	d.	£	s.	d.
Balance at Bank, January 1st ...				59	10	3
Subscriptions, 1892	0	10	0			
,, 1893	7	10	0			
,, 1894	105	10	0			
,, 1895	3	0	0			
				116	10	0
Sale of Soirée Tickets				18	16	0
Donations—B. Latham, Esq. ...	5	0	0			
,, Philip Crowley, Esq. ...	5	0	0			
,, F. C. Bayard, Esq. ...	5	0	0			
				15	0	0
				£209	16	3

Expenditure.

	£	s.	d.	£	s.	d.
Rent of Club Room, 12 months, to 31st July...				10	0	0
Hire of Rooms for Meetings ...				4	0	0
Printing Transactions, 1893 ...				30	3	0
Insurance				1	13	9
Postages				8	9	5
Meteorol. Sub-Committee Printing Rainfall Returns for the months December, 1893, to November, 1894, inclusive				27	11	0
Photographic Sub-Committee; Hire of Room for Lantern Exhibitions	2	15	0			
Rent of Dark Room, 12 months, to 31st July	10	0	0			
Sundry Printing, Postages and Gas	4	14	7			
				17	9	7
Bookbinding				0	17	0
Gratuities				1	6	0
Soirée Expenses, 1893				10	18	6
Soirée Expenses				50	2	11
Printing and Stationery				11	2	8
Sundries				1	0	1
Assistant Secretary				5	0	0
Balance (Bank, £28 15s. 4d.; Cash in hand, £1 7s.) ...				30	2	4
				£209	16	3

SPECIAL FUND ACCOUNT, 1894.

£210 11s. 8d. CONSOLS.

	£ s. d.	£ s. d.		£ s. d.	£ s. d.
Balance from last Account, Jan. 1st		4 11 4	Payments—		
Dividends—January	1 8 1		Microscope Stand		3 10 0
,, April	1 8 1		Linoleum for Club Room ...		2 17 6
,, July	1 8 0		Balance forward		5 1 0
,, October...	1 8 0				
		5 12 2			
Payments for use of Lockers in Dark Room		1 5 0			
		£11 8 6			£11 8 6

	£ s. d.
Balance brought down, at Bank	5 1 0
Balance General Account and Cash in hand ...	30 2 4
	£35 3 4

EDWARD B. STURGE, *Treasurer.*

We, the undersigned, having examined the above Accounts and the Vouchers relating thereto, hereby certify that they are correct, according to the Vouchers, and to the Bankers' Pass Book.

J. H. BALDOCK,
R. F. GRUNDY, } *Auditors.*

January 4th, 1895.

RULES OF THE CLUB.

Title and Objects of the Club.

THE Club shall be called "THE CROYDON MICROSCOPICAL AND NATURAL HISTORY CLUB," and shall have for its objects the mutual help of its Members in the study of Microscopy, Natural History, and Photography, the investigation of the Meteorology, Geology, Botany, and Zoology of the neighbourhood of Croydon, in the County of Surrey, and the dissemination amongst its Members of information on the subjects of Microscopy and Natural History.

Management of the Club.

1.—The business of the Club shall be conducted by a Committee (four to form a quorum), consisting of a President, Vice-Presidents (to consist of all past Presidents), a Treasurer, an Honorary Secretary, and nine other Members.

2.—The officers of the Club shall be elected at the General Annual Meeting. The President shall not hold office more than two years in succession. Of the nine Members of the Committee two shall retire each year, and shall not be eligible for re-election that year. The retiring Members shall be, (*a*) the one who has attended the smallest number of Committee Meetings during the past year; (*b*) the one who has served upon the Committee the longest. The remaining seven shall retain office without re-election. If two or more Members have an equal number of Committee Meetings, that Member shall retire who has served the longest. If two or more Members have served an equal length of time, that Member shall retire who has attended the Committee least often during the past year.

At a Committee Meeting held on March 14th, 1888, the following Resolutions were passed:—

I.—"That Lady Visitors introduced by Members be cordially welcome to join all the Excursions or Field Meetings of the Club."

II.—"That when in his judgment the Paper of the evening is likely to be of sufficient general interest, the President be empowered, with the consent of the reader of the Paper, to invite the attendance of Lady Visitors introduced by Members. Such invitation to be conveyed on the Notice convening the Meeting."

III.—"That the various sectional Sub-Committees be also empowered, when they think it desirable, to invite the attendance of Ladies as Visitors at any Meetings, whether out or indoor, held under their auspices."

Membership.

1.—Every candidate for Membership shall be proposed by two or more Members, one of whom at least shall have a personal knowledge of him, and who shall sign a certificate in recommendation of him, according to the form appended. The certificate shall be read from the chair, and the candidate therein recommended balloted for at the following meeting. One black ball in five to exclude.

2.—The Annual Subscription shall be 10s., payable in advance on the 1st of January (or on election, if previous to November), and no person shall be entitled to the privileges of the Club until his Subscription shall have been paid.

3.—Distinguished men may be elected Honorary Members of the Club; such Honorary Members shall not be subject to any of the expenses of the Club, and shall have no vote in its affairs.

4.—In order to encourage the study of Microscopy and Natural History amongst mechanics, &c., residing in the district, individuals of that class may be admitted as Associates, provided they shall first communicate some original information or observation on Microscopy or Natural History, or exhibit such specimens as shall, by their merit, satisfy the Committee. Such Associates shall enjoy the privileges of Honorary Members.

5.—No Member shall be considered to have withdrawn from the Club until he shall have paid his arrears, and given a written notice to the Secretary of his intention to resign.

6.—If it shall be thought desirable to expel any Member from the Club, the same shall be done by a resolution of the Committee, which shall be read at the next ordinary meeting; and at the following meeting a ballot shall take place with respect to the proposition, and if two-thirds of the Members present shall vote for such Member's expulsion, he shall no longer be considered a Member.

7.—Any Member may introduce a visitor at an ordinary meeting, who shall enter his name, with that of the Member by whom he is introduced, in a book kept for that purpose.

Ordinary Meetings.

1.—The ordinary meetings of the Club shall be held on the third Tuesday in every month (excepting the months of June, July, and August), at seven o'clock in the evening; the chair to be taken at eight precisely, or at such other time as the Committee may appoint.

2.—The ordinary course of proceedings shall be as follows:—

I.—The minutes of the previous meeting shall be read and submitted for approval as being correct.

II.—The names of candidates for membership shall be read, and the ballot for election of Members shall take place.

III.—Scientific communications shall be read and discussed; after which the chair shall be vacated, and the meeting shall resolve itself into a conversazione, to terminate at ten o'clock.

3.—In the absence of the President, the Members present at any ordinary meeting shall elect a Chairman for that evening.

4.—No Paper shall be read which has not received the sanction of the Committee; and, whenever it is possible, early notices of the subject of the Papers to be read shall be given by the Secretary to the Members. No Paper shall exceed twenty minutes in the actual reading, unless by the special permission of the Chairman.

5.—In addition to the above ordinary meetings, others, for conversation and the exhibition of Microscopical objects and Natural History specimens, and for the borrowing and exchanging of books, shall be held on the last Wednesday in each month throughout the year, at eight o'clock in the evening.

6.—Photographic meetings shall be held on the first Friday in each month throughout the year, at eight o'clock in the evening.

Business Meetings and Election of Officers.

1.—The accounts of the Club shall be audited by two Members appointed at the ordinary meeting in December. No Member of the Committee shall be eligible as an Auditor.

2.—At the same meeting, notice of the Annual Meeting in January shall be given from the chair.

3.—An Annual Meeting of the Club shall be held, in place of the ordinary meeting, on the third Tuesday evening in January, at eight o'clock, when the election of officers for the year ensuing shall take place; and the Report of the Committee on the affairs of the Club, and the Balance-sheet, duly signed by the Auditors, shall be read.

4.—The Officers of the Club shall be nominated in writing, and such nominations shall be sent to the Secretary seven clear days before the Annual Meeting. In the event of the number of nominations exceeding the number of officers to be elected, a printed list of the nominations shall be circulated at the Annual Meeting, and the Members present shall vote by ballot by striking out the names of those for whom they do not desire to vote, and placing the lists in an urn upon the table. Scrutineers shall be appointed at the meeting, and the votes shall be counted during the course of the meeting.

5.—No permanent alteration in the Rules shall be made except at one of the monthly meetings of the Club, and notice of any proposed alteration or addition must be given at or before the preceding ordinary meeting.

Library.

1.—Applications for the loan of books or microscopical slides to be made to the Hon. Librarian at any "ordinary" or "conversational" meeting of the Club, the borrower to sign a receipt, which will be cancelled on the return of the work borrowed.

2.—No Member may have more than one work at a time.

3.—No work may be retained longer than one month, but the same work may be again borrowed provided there be no other applicant for it. Any Member not complying with this rule will incur a fine of 1s. for each month after the first that the work is retained.

4.—The borrower shall make good all damage which any book, &c., may receive while under his charge; such damage to be assessed by the General Committee.

5.—Books marked "R" (reference) and unbound pamphlets are not to be removed from the reading-room.

6.—No Member will be entitled to the privileges of the Library who has not paid such fines as he may have incurred.

LIST OF MEMBERS.

Revised to June, 1895.

Date of Election.	
12 Oct. 1887.	ADAMS, WALTER R., 16 Chepstow-road.
9 Mar. 1887.	ALLDER, JOSHUA, Dunlewey House, Bedford Park.
9 Aprl. 1884.	ALLEN, A. H., Leslie Lodge, Lower Addiscombe-road.
14 May, 1890.	ASHCROFT, WILLIAM, Layhams Farm, Beckenham.
19 Mar. 1879.	BACKWELL, R. J., 42 Balfour-rd., South Norwood, S.E.
9 Jan. 1889.	BACKWELL, WILLIAM EDGAR, 42 Balfour-road, South Norwood, S.E.
19 Nov. 1873.	BAILEY, EDWIN, 10 Lansdowne-road.
4 May, 1870.	BAKER, SAMUEL, Lansdowne-road.
8 Oct. 1890.	BAKER, WM. R., 9 Belmont Villas, Wallington, Surrey.
Original.	BALDISTON, FREDERICK, Ashleigh, Addiscombe-road.
15 Aprl. 1874.	BALDOCK, J. H., F.C.S., Overdale, St. Leonard's-road, Duppas Hill.
9 Sept. 1885.	BARBER, J. H., 92 Oakfield-road.
9 Nov. 1892.	BARLOW, FRANK, Clevedon, Lower Addiscombe-road.
21 Jan. 1891.	BARKER, WALTER T., Elmwood, Waddon-road.
10 Mar. 1886.	BAYARD, F. CAMPBELL, LL.M., F.R. Met. Soc., Malden-road, Wallington, Surrey.
14 Mar. 1888.	BEARD, Dr. F., Brighton Road House.
15 Mar. 1871.	BEEBY, WILLIAM H., F.R.M.S., Vaila, Burwood Park Road, Walton-on-Thames.
Original.	BERNEY, JOHN, F.R.M.S., Chatsworth-road.
15 Jan. 1895.	BERRY, B. H., Highlea, Spencer-road.
8 Feb. 1893.	BINYON, GEORGE, Allandale, Coombe-road.
13 May, 1891.	BISHOP, ALFRED, Ringstead Lodge, Whitehorse-road.
Original.	BLAKE, W. J., Elmfield, Park-lane.
9 Dec. 1891.	BOTTOMLEY, JOHN, Dobroyd, Birdhurst Rise.
10 Dec. 1884.	BREBNER, G. REITH, M.D., 232 London-road.
15 Dec. 1880.	BREWER, J. G. B., Havelock-road.
11 Apl. 1888.	BROCK, ARTHUR, Chagford, Selhurst-road, S. Norwood, S.E.
19 Feb. 1873.	BRODIE, ROBERT, M.A., George-street.
13 May, 1891.	BROWN, WM. CHAS., 27 The Waldrons.
11 Nov. 1891.	BROWN, WM. HY., 3 Lavender-road, Sutton, Surrey.
10 Nov. 1886.	BROWN, J. WEIR, Ferndean, Heathfield-road.
12 Nov. 1884.	BUCKLAND, JOHN WELLINGTON, Ashburton-road.
9 Jan. 1889.	BULLOCK, WILLIAM C., 20 Dingwall-road.
21 Mar. 1877.	CARPENTER, A. B., B.A., M.R.C.S., F.R.M.S., Bedford Park.
12 Nov. 1892.	CARRINGTON, LOUIS, Panmure, Tavistock-road.
13 Jan. 1892.	CARTER, FRANCIS, High-street, Carshalton, Surrey.
11 Jan. 1888.	CASH, WILLIAM, 15 Fairfield-road.
15 Jan. 1874.	CHAMBERS, W. E., J.P., Eversfield, Sutton, Surrey.
15 Dec. 1880.	CHEESWRIGHT, F. R., Maythorne, Birdhurst Rise.

Date of Election.	
16 May, 1877.	CHISHOLM, JAS., Addiscombe Lodge, Addiscombe-road.
19 Aprl. 1876.	CHUMLEY, JOHN, Worcester Lodge, Canning-road.
10 Dec. 1891.	CLARK, HENRY, 2 Ventnor Villas, Waddon New Road.
16 May, 1877.	CLARKE, JOSIAH, 88 George-street.
11 Mar. 1891.	COLDWELLS, WM. H., Woodside-road, South Norwood.
18 Jan. 1882.	COLLYER, HENRY C., Homewood, Haling Park-road.
21 Oct. 1887.	COLLYER, BRYCE, Yen Bank, Sanderstead-road.
11 Jan. 1893.	COOPER, H. J., M.B., Southwood, Birdhurst-road.
16 Aprl. 1873.	CORRY, JOHN, J.P., Rosenheim, Park Hill-road.
14 Dec. 1887.	COUCHMAN, ALFRED, Houghton, Birdhurst Rise.
21 May, 1879.	COWDELL, H. S., Cotleigh, West Wickham, Beckenham.
11 Jan. 1893.	CRABB, GEO., Red House, Campden-road, S. Croydon.
Original.	CROWLEY, PHILIP, F.Z.S., Waddon House.
20 May, 1874.	CURLING, GEORGE, Elgin House, Addiscombe-road.
20 Dec. 1894.	CURRY, MATTHEW, Jun., 62 Coombe-road, S. Croydon.
Original.	CUSHING, THOS., F.R.A.S., 2 Southside, Chepstow-rd.
10 Dec. 1890.	CUTLER, WM. C., Derwent Bank, Addiscombe-road.
18 Aprl. 1877.	DAVIES, ARTHUR CAPEL, The Glen, Duppas Hill.
16 Jan. 1894.	DEAN, EDMUND, 28 Oliver-grove, South Norwood.
15 Sept. 1875.	DICKINSON, WILLIAM, M.A., F.G.S., Warham-road.
Original.	DIX, T. H., 81 High-street.
9 Dec. 1891.	DODD, W. H., Woodstock-road.
11 May, 1887.	DOWN, H. W., Bank Chambers, North End.
9 Jan. 1884.	DRAGE, JOHN HENRY, Tamworth-road.
18 Sept. 1878.	DRAGE, JOHN, Tamworth-road.
9 Sept. 1891.	DREW, HY. WM., Eastleigh, Addiscombe-road.
18 Oct. 1893.	DUKES, T. A., M.B., B.Sc., 16 Wellesley-road.
18 May, 1887.	DUNCAN, PETER THOMAS, M.D., Park-lane.
11 Feb. 1891.	DURHAM, ROBT., 23 Fairfield-road.
18 Dec. 1894.	DYER, FRED. CARR SWINERTON, Major, Hazelea, Kenley, Surrey.
14 Sept. 1887.	EAST, FREDERICK W., Timberham, Horley, Surrey.
16 Aprl. 1879.	EATON, H. S., M.A., F.R. Met. Soc., 4 Belfield Terrace, Rodwell, Weymouth.
12 Nov. 1890.	EDRIDGE, FREDK. T., J.P., Addiscombe Court.
9 Dec. 1885.	ELBOROUGH, C. M., Hazlehurst, Park Hill-road.
19 Jan. 1881.	EPPS, JAMES, Jun., Norfolk House, Beulah Hill, Upper Norwood, S.E.
9 Jan. 1884.	FALK, FERDINAND, 1 Park Hill-road.
1883.	FENN, W. G., Heath Lodge, Thornton Heath, S.E.
18 Dec. 1894.	FITZGERALD A., 93 Addiscombe-road.
9 Mar. 1892.	FLINT, RICHARD, Woodstock House, Park-lane.
13 Mar. 1889.	GIBB, JAMES, The Quarries, Park Hill-road.
19 Oct. 1881.	GIBSON, WALTER, M.A., 1A Lower Grosvenor-place, London, S.W.
9 Feb. 1887.	GOODMAN, C. H., Bryn Cottage, Whyteleafe, Surrey.
11 Feb. 1891.	GOSCHEN, H., Heathfield, Addington.
14 Jan. 1885.	GOWER, HARRY DOUGLAS, 16 Wandle-Road.

Date of Election.	
12 Jan. 1887.	GREENWAY, HENRY, Ulimbah, Ashburton-road.
9 Dec. 1891.	GROCOCK, LEONARD O., 21 Beckenham-rd., Penge, S.E.
8 Aprl. 1885.	GRUNDY, RICHARD F., 112 Lower Addiscombe-road.
19 Dec. 1893.	GUIMARAENS, H. EDWARD, Parkside, Warham-road.
18 Jan. 1882.	GUIMARAENS, P. G., Parkside, Warham-road.
Original.	HADDOCK, ROLAND, 9 The Waldrons.
13 Jan. 1892.	HALL, JOSEPH, Melton Lodge, Havelock-road.
10 Dec. 1892.	HARLAND, ARTHUR F., 32 Park-lane.
18 May, 1881.	HART, P. S., Lyndhurst, Fairfield-road.
15 Jan. 1895.	HEHNER, CHAS. W., Woodside House, Woodside-green, South Norwood, S.E.
14 Mar. 1888.	HELPS, JAMES W., As.M.I.C.E., 3 Tavistock-road.
18 Dec. 1894.	HILLS, DAVID, St. Brelades, Elm-road, Beckenham.
12 Jan. 1887.	HINDE, Dr. GEORGE J., F.G.S., Avondale-road.
9 Aprl. 1890.	HIRST, ARTHUR WM., St. Michael's-road.
21 Sept. 1881.	HOBSON, J. M., M.D., 65 Lower Addiscombe-road.
19 Mar. 1895.	HODSOLL, SYDNEY, 16 Wellesley-road.
11 Feb. 1891.	HOLAH, ERNEST, 30 Havelock-road.
12 May, 1886.	HOLMES, W. MURTON, Glenside, St. Peter's-road.
19 Sept. 1893.	HOOLE, A. P., The Willows, Sutton, Surrey.
15 Jan. 1890.	HOPEWELL, J. M., 79 Lansdowne Gardens.
Original.	HORSLEY, HENRY, M.R.C.S., London-road.
11 Aprl. 1888.	HOVENDEN, ERNEST C., 4 Blomfield-street, London Wall, E.C.
16 Feb. 1881.	HOVENDEN, R. G., Heathcote, Park Hill-road.
21 Jan. 1891.	HOVENDEN, ALBERT, Jun., Oaklands, Haling Park-rd.
11 Mar. 1885.	HUGHES, MORGAN, M.R.C.S., L.D.S., Eastbridge, Addiscombe-road.
12 Mar. 1890.	I'ANSON, WILLIAM HENRY, 39 Dingwall-road.
17 May, 1871.	INGRAMS, WILLIAM, Whitgift Schools, Church-road.
12 Nov. 1892.	ISABELL, Rev. JNO., 65 Waddon-road.
16 Dec. 1874.	JARRETT, C., 30 St. John's-grove.
19 Feb. 1895.	JERRAM, FREDK. HORACE OLDERSHAW, 40 Longley-road, Tooting.
16 Feb. 1881.	JUSTICAN, J. W., B.A., Outram-road.
14 Nov. 1888.	KLAASSEN, H. M., Aberfeldy, Campden-road.
10 Jan. 1883.	KÜSTER, GUSTAV, 14 Dingwall-road.
21 Nov. 1877.	LAING, R. A., 43 Upper Addiscombe-road.
8 Aprl. 1885.	LANFEAR, CECIL, Rockwood, Chichester-road.
Original.	LATHAM, BALDWIN, C. E., Duppas House.
11 Jan. 1893.	LEAVER, ARTHUR, Walbrook Lodge, Barham-road.
Original.	LEE, HARRY, 20 St. John's-grove.
13 Aprl. 1892.	LINCOLN, J. G., Kirkdale, Selsdon-road.
9 Sept. 1891.	LLOYD, FRANK, Coombe House, Coombe-road.
11 May, 1892.	LLOYD, ARTHUR, Shirley Hurst, Shirley, Surrey.
19 Feb. 1895.	LOCK, WILLIAM J., Llanberis, Avondale-road, Croydon.
Original.	LONG, HENRY, 132 High-street.
18 Feb. 1874.	LOVETT, EDWARD, 41 Outram-road.

Date of Election.

15 Jan. 1895. MALDEN, ARTHUR, 5 Chatfield-road, Croydon.
13 Mar. 1889. MANSFIELD, CHARLES, The Lindens, Coombe-road.
10 Mar. 1886. MARSHALL, ROBERT, Broomfield, The Avenue, Duppas Hill.
8 May, 1889. MARTIN, HOWARD, Bolney Grange, Havelock-road.
20 Feb. 1878. MATHER, C. W., 47 Dingwall-road.
8 Dec. 1886. MAYLARD, MARTIN W., 86 Lower Addiscombe-road.
15 Jan. 1895. McCLIVE, WM. J., 16 St. John's-grove, Croydon.
Original. McKEAN, KENNETH, F.L.S., Lloyds, London, E.C.
10 Nov. 1886. McLACHLAN, ROBERT, F.R.S., F.L.S., 23 Clarendon-rd., Lewisham, S.E.
19 Mar. 1879. MENNELL, H. T., F.L.S., Park Hill Rise.
19 Mar. 1895. MOORE, GEO. WM., Bryndhurst, Dornton-road, South Croydon.
21 May, 1873. MORLAND, CHAS. C., Rastrick Lodge, Morland-road.
14 Nov. 1883. MORLAND, CHAS. ERNEST, Kelvedon, Fairfield-road.
9 May, 1888. MORRIS, WILLIAM, C.E., The Kent Waterworks, Deptford, S.E.
15 Dec. 1880. MORRIS, A. M., Harcourt-road, Wallington.
19 May, 1880. MORTON, SHADFORTH, M.D., Wellesley Villas, Wellesley-road.
19 Feb. 1895. MOSS, ABRAHAM, 3 High-street, South Norwood, S.E.
14 Dec. 1892. MOSS, CHARLES, Heatherley, Coombe-road.

Original. NATION, W. J., 40 Thornton-rd., Thornton Heath, S.E.
13 Mar. 1889. NEALL, GEORGE, 88 Lower Addiscombe-road.
20 Mar. 1894. NEEVES, GEO. EDWARD, Cromer Lodge, Birdhurst-rd.
19 Mar. 1895. NEWBY, GERVASE E., F.R.C.S., The Hollies, 61 Lower Addiscombe-road.
18 Dec. 1894. NORTON, WALTER CHARLES, Maycourt, Campden-road, South Croydon.

11 Jan. 1888. OAKLEY, CHARLES F., 12 Sudbury-road.
18 Feb. 1874. OLDFIELD, JOHN, 16 Tamworth-road.
15 Jan. 1895. OLIVE, CHARLES DANIEL, M.A., Rokeby, The Downs, Wimbledon.

15 Jan. 1895. PACK, FREDK. JAMES, 8 High-street, Croydon.
9 Mar. 1892 PACKHAM, JAMES, 16 Katharine-street.
12 Oct. 1892. PAGE, THOS. K. F., 9 Rosemount, Wallington, Surrey.
18 May, 1881. PARSONS, H. FRANKLIN, M.D., F.G.S., Oakhyrst, Park Hill Rise.
15 Jan. 1895. PARSONS, SAMUEL GEORGE, Vallis Leaze, Raynes Park, Wimbledon.
10 May, 1893. PASCALL, JAMES, Ambleside, Duppas-road.
12 Mar. 1893. PEACOCK, THOS., Tremonia, Chichester-road.
17 Jan. 1877. PELTON, JOHN, Chatfield House, London-road.
11 Feb. 1891. PELTON, JOHN OLLIS, 26 Friends'-road.
10 Nov. 1886. PEMBROKE and MONTGOMERY, Rt. Hon. the Earl of, Hillingdon-place, Uxbridge.
9 Dec. 1885. PERKINS-CASE, P. W., M.D., 254 London-road.
12 Nov. 1884. PERRY, EDWARD SEAGER, The Highlands, Duppas Hill.
20 Mar. 1894. PERRY, H. W., The Cedars, London-road.

Date of Election.	
19 Jan. 1881.	PHILIPS, JAMES, Woodlands, Wellesley-grove.
9 Mar. 1892.	PHILLIPS, H. WHITBY, M.D., Addiscombe-road.
4 May, 1870.	PHILPOT, CHARLES W., M.D., Friends' House, Park-lane.
13 Mar. 1889.	PITTMAN, J. J., 59 Dingwall-road.
Original.	PRICE, GEORGE N., 72 High-street.
14 Sept. 1887.	PRINCE, JAMES WEBSTER, Brickwood House, Addiscombe-road.
9 Nov. 1887.	PURSER, J., 41 Addiscombe-road.
9 Aprl. 1890.	PURSER, FREDK. WM., 41 Addiscombe-road.
21 Jan. 1880.	PYE-SMITH, ARNOLD, J.P., Park Hill Rise.
14 Jan. 1885.	READ, JOHN PHILIP, Eversfield, South Park Hill-road.
14 Jan. 1885.	REED, LESTER, F.C.S., F.I.C., Hyrst Hof, South Park Hill-road.
9 Aprl. 1890.	REID, ST. GEORGE C., Brigstock Villa, Thornton Heath, S.E.
15 Sept. 1880.	RICH, ALFRED WM., The Grove, Chatsworth-road.
16 Jan. 1894.	ROBARTS, N. F., F.G.S., Abingdon, Addiscombe-grove.
19 Mar. 1895.	ROGERS, HENRY, Altamont, Warlingham, Surrey.
11 Jan. 1888.	ROODS, ALFRED, 15 St. James's Park.
12 Mar. 1890.	RUSSELL, ALFRED CRAKE, 60 Clarendon-road.
21 May, 1895.	RUSSELL, CHARLES JAMES LAWRENCE, Upton Dene, 56 Coombe-road.
18 Aprl. 1877.	RYMER, S. L., J.P., Wellesley-road.
13 Jan. 1892.	SALMON, CHAS. E., Clevelands, Wray Park, Reigate.
13 Aprl. 1892.	SAMSON, W. E., 55 Bensham Manor-road, Thornton Heath, S.E.
12 Sept. 1888.	SANDELL, JOHN T., Abbotsford, 23 Bensham Manor-road, Thornton Heath, S.E.
14 Jan. 1885.	SAUNDERS, THOMAS DODGSON, Twyfordbury, Park Hill Rise.
19 Feb. 1895.	SAUNDERS, THOMAS CHARLES CASTLE, Aberfoyle, Addiscombe-grove, Croydon.
11 Aprl. 1888.	SCHMITZ, J. H., J.P., Lansdowne-road.
15 Jan. 1895.	SERRES, Rev. HENRY ARTHUR, St. John's Lodge, Addiscombe.
10 Nov. 1886.	SHEARER, DONALD, Park Hill House.
13 May, 1885.	SHORE, E. L., Lansdowne Villas, Wellesley-road.
8 Feb. 1888.	SMITH, HAROLD, F.R. Met. Soc., Ingleside, Kenley.
13 Feb. 1884.	SMITH, Dr. S. PARSONS, Addiscombe-road.
17 Aprl. 1894.	SMITH, HENRY DOLLING, 19 Cedars-road, Beckenham.
16 Oct. 1894.	SMITH, WILLIAM JOHN LANCELOT, Ravenswood, Newlands Park, Sydenham.
9 Jan. 1889.	SPARROW, C. H. BURNABY, 1 Chepstow-road.
Original.	STANLEY, W. F., F.G.S., Cumberlow, S. Norwood, S.E.
20 Feb. 1878.	STRAKER, E., Richmond, Malden-road, Wallington, Surrey.
11 Jan. 1888.	STREETER, J. S., High-street.
Original.	STURGE, EDWARD B., The Waldrons.
16 Sept. 1874.	SWAINE, J. C., Park Hill-road.
13 Sept. 1882.	SYMS, JOHN E., Stanton Villa, Stanton-road.

Date of Election.	
11 Nov. 1885.	Terry, W., 2 Frascati, Surbiton, Surrey.
16 Jan. 1878.	Thompson, H. G., M.D., 86 Lower Addiscombe-road.
20 Nov. 1894.	Thompson, H. C., Horndean, Waddon.
17 Nov. 1880.	Thompson, Francis, Haling Park-road.
13 Jan. 1892.	Thorpe, Charles, 22 George-street.
9 Aprl. 1890.	Underhill, Alfred, 32 Clarendon-road.
21 Jan. 1891.	Vesey, Arthur H., Bradon House, George-street.
19 Dec. 1877.	Walker, Thomas, C.E., Warrington-rd., Duppas Hill.
19 Dec. 1893.	Walters, F. R., M.D., 5 Fairfield-road.
20 Dec. 1876.	Walton, A., The Homestead, Bedford Park.
19 Sept. 1877.	Warner, A., 2 Grosvenor Villas, Holmesdale-road, Selhurst, S.E.
20 Aprl. 1881.	Waterall, Nathaniel, Waddon Lodge, Croydon.
21 Jan. 1891.	Watson, Chas. E. L., 87 Lansdowne-road.
21 May, 1895.	Weightman, Arthur John, Langdale, Chepstow Rise.
17 Oct. 1877.	Wenham, W. P., 109 London-road.
Original.	West, Frederick, The Waldrons.
17 Mar. 1875.	Whealler, G. Anson, 9 Friends'-road East.
12 Nov. 1890.	Whealler, Spencer E., 9 Friends'-road East.
9 Nov. 1887.	Wild, A. Scott, 28 Canning-road.
12 Dec. 1883.	Williams, Bertram Alex., L.D.S., 22 Wellesley-road.
12 Aprl. 1882.	Willoughby, C. W., 28 Friends'-road.
13 Nov. 1889.	Wise, Howard R., Beechfield, Bromley-hill.
15 Jan. 1895.	Wissenden, Arthur Chas., 50 Canning-road.
13 May, 1885.	Witt, T. J., 44 Dingwall-road.
17 May, 1871.	Woodward, John, 21 Canning-road.
12 Oct. 1887.	Wratten, F. C. L., Dingwall-avenue.
12 Oct. 1887.	Wratten, Sidney Herbert, Dingwall-avenue.
13 May, 1891.	Youle, A. P., Olinda, Addiscombe-road.
12 Mar. 1890.	Yuill, Charles J. M., Marion Villa, Addiscombe-rd.

Honorary Members.

9 Sept. 1885.	Berney, Frederick Lee, Ravensbourne, Tambo, Queensland.
21 Aprl. 1875.	Cole, R. Beverley, M.D., San Francisco, California, U.S.A.
16 Aprl. 1879.	Evans, Sir John, K.C.B., D.C.L., F.R.S., Hemel Hempstead, Herts.
16 Aprl. 1879.	Flower, Sir W. H., K.C.B., LL.D., F.R.S., Natural History Museum, South Kensington, London, S.W.
16 Aprl. 1879.	Prestwich, Prof. Joseph, Shoreham, Sevenoaks, Kent.
20 Mar. 1894.	Sarjeant, W. Low.
11 Jan. 1888.	Symons, G. J., F.R.S., 62 Camden-square, N.W.

Associates.

20 Aprl. 1881.	Collyer, Edward B., 146 Selsdon-road.
11 Nov. 1885.	Rodbourn, J.

TRANSACTIONS

OF

THE CROYDON MICROSCOPICAL AND NATURAL HISTORY CLUB.

1894–95.

116.—Some Points in the Life-history of Bacteria.

By J. M. Hobson, M.D., B. Sc.

Read March 20th, 1894.

I do not intend in this paper to give undue prominence to the medical aspects of Bacteriology, remembering that this is neither a medical nor a popular audience, but a philosophical society; nor, as the title indicates, do I propose to give a complete *résumé* of the known facts in what has grown to be a science in itself. I have simply selected such of the salient points in the life-history of Bacteria as I think will be interesting to the members of this Club. On some of these points I shall dwell very lightly, of others I shall treat more fully.

Name.—βακτήριον is the Greek for a staff or baton, and as the forms most readily observed are rod-shaped, the term has been retained as a convenient one for the entire group of organisms, although some are spiral, some cylindrical, and many are spherical.

Botanical Position.—The Bacteria are all included in the group or family of *Schizomycetes* (from *σχίζω, I cut,* and *μύκης, a fungus*), or fission fungi, from their characteristic mode of multiplication. De Bary, of Strassburg, however, objects to the notion of regarding them as fungi, and is disposed to combine them with the Nostocaceæ—which are generally grouped with the algæ, and which also multiply by equal subdivision—and to give the name to the entire family of Schizophytes or fission plants.

Morphology.—The individual cells, in common with all other members of the vegetable kingdom, have walls of cellulose with protoplasmic contents, the outer part of the cell-wall being

capable of more or less gelatinous swelling so as to bind the cells into a more or less compact mass. There are three types of form as I have already indicated, namely, the cylinder, the spiral, and the sphere, with certain modifications, giving origin to the terms, which are used generically, of *bacillus* or a little rod, *spirillum*, and *coccus*, the latter having generally the prefix *micro*—micrococcus. In spirillum a single cell forms only a portion of one complete turn of the thread. With few exceptions the cells are very minute, $\frac{1}{25000}$ inch being about the most usual diameter. In studying the morphology of fungi and algæ, we are in the habit of regarding the cells as only parts of the fabric, but in the case of the Schizomycetes the cells appear to have more individual importance. The reason for this is that the genetic connection of the cells is of the loosest character, and there is, properly speaking, no structure at all. Under the microscope the cells commonly appear as mere crowds, no cell having any continuity with its neighbour, or at most they are strung together like rows of beads. Yet there are characteristic *macro*scopic appearances whereby such differentiation as may be made out by the microscope can be amplified. Another aid to differentiation is in their life-products and effects. The term zooglœa is applied to these aggregations of cells under certain circumstances; but since cultivation on solid media has largely replaced the older methods of growing in fluids, the term has not the same significance.

Motility.—The cells may be non-motile throughout, or like the hay bacillus (*B. subtilis*), they may be motile in the earlier stages of their existence and non-motile in their later zooglœa stage. In several cases cilia can be demonstrated. They appear in photographs, and the extraordinary development there shown may even suggest a doubt of their real existence as such, seeming "too good to be true." Micrococci are, as a rule, non-motile, though a micrococcus has been figured with a flagellum.

Reproduction.—This may be in the way of *fission* already indicated, or by *spore formation*. In the former a fine transverse line makes its appearance across the shorter diameter of the cell, when there is a shorter one, dividing it into two equal parts, which gradually thickens, being a development of cellulose, and thus prepares for the complete separation of the cells. *Spore formation* is most often endogenous, but some species are arthrosporous. In some species the spore, instead of forming in the middle of the mother-cell, forms at one end, causing thereby a drumstick appearance. In hay bacillus, anthrax bacillus, and others, the spore formation begins only when the food material is nearly exhausted, or the vegetative process is stopped through certain products formed, and requires the presence of a free supply

of oxygen. In *Bacillus amylobacter*, on the other hand, it is not necessary to spore formation that the food material should be exhausted. Moreover, some, at any rate, of the anaerobic bacteria, *i. e.*, bacteria which vegetate without free oxygen, produce their spores anaerobically. The spores have a dense sheath, which may be gelatinous in its outer part, and this condition of the sheath enables the spores to resist agencies which destroy the vegetative cells. They can resist a dry temperature better than the same temperature in water. They can stand drying, and are capable of sprouting after many months, when placed in favourable conditions of warmth, moisture, and nutrition.

Colour.—Bacteria are mostly colourless, but there are exceptions. One, *Bacterium chlorinum*, contains chlorophyll, and is said to decompose carbonic acid. Other bacteria appear coloured red, orange, yellow, blue; while others, again, are colourless in themselves but create colours in their nutrient media; indeed, it appears that even in bacteria-masses which show bright colours, the pigment is in granules outside the cells, in fact that the pigment in one case is soluble in water, in another is insoluble. The red colouring matter, however, called bacteriopurpurin, found in one species, is allied to chlorophyll, and is really contained within the cell.

Distribution in Time and Space.—*In time* there is evidence that a bacterium existed so far back as the Carboniferous Era, for Van Tieghem has found in sections of silicified plants, which were in process of softening at the time, remains of an organism which exactly resembles *Bacillus amylobacter* of our day, and appears to have had the identical function with it of destroying the cellulose elements of plants. *In space* bacteria may be found anywhere and everywhere. Yet that there is a difference in specific distribution may go without saying, some species being very common and others comparatively rare. I am not aware that the experiment has been widely made, but I venture to predict that if in any part of the earth where vegetable and animal life could be sustained, an ordinary infusion of organic matter were exposed to the air for a longer or shorter time, the hay bacillus and other common forms would make their appearance. The reverse we know must obtain with regard to some of the parasitic forms, as evidenced by cases where small-pox or measles were introduced amongst a native community *de novo*, or reintroduced after long entire cessation. The North American Indians, Greenlanders, and Icelanders, in the former case, and the South Sea Islanders in the latter, were stricken down wholesale by the advance of the disease in a virgin soil.

Habitat.—That many bacteria are strictly aquatic is well known, and was shown in a very positive manner by Prof. Percy

Frankland, who found that certain forms could not only live but multiply in distilled water. Very pure deep well-water also, which may contain but five organisms to the cubic centimetre, after keeping in a closed sterilized vessel for a few days, may contain as many as 500,000 in the same space. The few bacteria which have gained an access to this virgin soil can thus multiply without check. Every pinch of garden mould contains enormous numbers of bacteria, though some of these may be amongst those which can thrive in water. It cannot be supposed that any bacteria are really aerial in their habitat, for they would lack the moisture they require for growth for one thing; yet, except at very great heights, or well out to sea, it is not possible to examine any considerable volume of air without finding any. The reason for this clearly is that bacteria are so exceedingly minute, and are so intimately associated with the multitudinous things that give off dust, that they are carried upwards by various currents and mingled with the mass of the atmosphere by the winds. It is well known that some bacterial cells will survive a long period of drying, that the spores are much more proof against this form of destruction, and that either, directly they light upon a spot where the requisite warmth, moisture, and nourishment are combined, will vegetate and multiply. It is therefore not surprising that under these circumstances bacteria should find their way to wherever non-living organic solids or liquids exist. Whether they should multiply in these situations depends upon circumstances. It does not appear, however, that they can be found within the blood or solid tissues of perfectly normal living beings. Their presence in the mouth, intestines, &c., of living animals is not an exception to the rule, for these parts are, strictly speaking, outside the living tissues.

Effects of Oxygen and Light.—Pasteur used the terms aerobic and an-aerobic to denote the extremes in relation to oxygen, the former indicating organisms to which the presence of plenty of oxygen was essential to their growth, while the latter implied that the organisms could get their oxygen out of the organic compounds in their nutrient medium, and that the presence of free oxygen reduced their vegetation to a minimum or stopped it. Typical of the aerobic forms is the hay bacillus, *B. subtilis;* of the anaerobic, the various putrefactive organisms and the bacillus of tetanus. There are intermediate conditions, however, and when I come to speak of cholera I shall show how the characteristics of the organism can be modified by aerobic and anaerobic growth respectively. Oxygen has also a powerful effect upon the movements of bacteria, attracting the aerobics and repelling the anaerobics. De Bary quotes a very pretty experiment illustrating this. A piece of alga and bacteria are placed in water containing no free oxygen. As the alga begins liberating

oxygen from the dissolved carbonic acid, little bubbles will form upon it, and round these the bacteria will collect. Engelmann has shown that the coloured bacteria are attracted by the red rays of the spectrum. Janowski, on the other hand, found that the typhoid bacillus was killed by a few hours' exposure to direct sunlight, and that the violet or actinic portion had this destructive power. Phosphorescence in waters has been found to be largely due to several species of bacteria.

TEMPERATURE EFFECTS.—As might be expected, this has a great effect upon the growth of bacteria. Different species have a temperature at which their growth is most luxuriant, as well as temperatures above and below this point at which vegetation ceases. These several points are called respectively, optimum, maximum, and minimum. The optimum is commonly from 80° to 100° F. The maximum is often not much above the optimum. There is a higher temperature still, which quickly kills the bacteria. In liquids this is from 120° to 140° F., and destruction is certainly effected in boiling water. Spores are far more resistant to heat than the developed cells. In producing artificial immunity to infectious diseases it is well known that a profound effect upon the powers of certain bacteria is exercised by prolonged exposure to certain temperatures.

INTERACTION BETWEEN BACTERIA AND THEIR NUTRIENT MEDIA.—This is a very important and extensive subject, and can only be somewhat sketchily dealt with in this paper. These plants having, with the exception of the coloured forms, nothing like chlorophyll in their protoplasm, are, like the fungi, entirely dependent upon organic compounds for their carbon and nitrogen. Experiment has shown which combinations go to make the most suitable media for individual species, wherein they may reach their fullest development, but all, unless we except the case of the water bacteria, must contain carbon and nitrogen in organic combination, and mineral elements as well. Now the effect upon the substratum is often very marked. *Saccharomyces cerevisiæ*, the yeast plant, does not belong to this group, but its effects are so well known that it may be taken as a type of other fermentations. There must be present, besides sugar, nitrogenous organic compounds and ash, and at least three-fourths of water. The products are carbonic acid, succinic and lactic acids, glycerine, and alcohol. Yet the yeast consumes for itself but 1·25 per cent. of the sugar, 4–5 per cent. goes to make the acids and glycerine, and 94–95 per cent. becomes broken up into alcohol and carbonic acid. Chemically, the rearrangement of the sugar molecule forms two molecules of alcohol, two of carbonic acid, and one of water. When the alcohol amounts to one-fifth of the weight of the liquid it arrests the fermentation. *Acetous fermentation* is set up when an acid nutrient fluid containing a small percentage

of alcohol is exposed to the air at a temperature of about 80° to 100° F. The *Micrococcus aceti* lights upon this mixture, and under the circumstances grows, fermenting the alcohol into acetic acid. This is a partly oxidising process. Other fermentations produced by bacteria are instanced as follows:—*The turning of milk*, the sugar of milk being converted into lactic acid, and the acid precipitating the casein; *the conversion of urea* into carbonate of ammonia; the complicated fermentations of albuminous compounds through stages into carbonic acid and ammonia, the nitrifying of the resulting ammonia forming nitrates. Other products of bacterial growth are pigments, which have also been spoken of as ferment products. Again, there is the production of certain bodies of the diastase type. Germinating seeds, as is well known, produce an albuminous body called diastase, which has the power of converting starch into grape sugar. The yeast plant also *inverts* cane sugar into grape sugar by means of a similar body. The term enzyme has been applied to these substances. In the animal economy these bodies are represented by pepsine, pancreatin, and so forth. They have this in common, that under suitable conditions they have the power of converting organic compounds into other forms without themselves entering into chemical combination. Lastly, bacteria have the power of forming out of their pabulum various alkaloids. The term ptomäines has been applied to these, from πτῶμα, a dead body, because they have been found in decaying animal matter. Some of these alkaloids are highly poisonous, and have been obtained from cases of cholera, hydrophobia, tetanus, &c., and when given to animals have produced symptoms resembling some of those obtaining in these several specific diseases. There is reason to think that the production of specific alkaloids sometimes requires the collaboration of two different organisms. It is certainly the case that bacterial products are dependent very largely upon the character of the nutrient medium, and upon the presence or absence of oxygen. The fermentative phase of *Saccharomyces* is really anaerobic, although the presence of oxygen is necessary for a *pre*-fermentative stage in which the production, simply, of fresh cells takes place. I shall give an instance of this again when I come to speak of cholera.

Parasitic Bacteria.—By this are meant bacteria which actually live and multiply within the living fluids and tissues. Bacteria which merely find a home within the alimentary canal, where they regularly exist without producing any harmful results, are not regarded as parasitic. A more strictly scientific term would be infective bacteria, for it is their power of producing more or less profound effects upon the living tissues, of causing local or general infective diseases, which has called so much attention to them, and has in fact created the science of

bacteriology. All three types—*Bacillus*, *Spirillum*, and *Micrococcus*—have their representatives among the infective bacteria. It would be interesting to enumerate these so far as they are known, or are fairly presumed to exist.

Some of the Infective (Pathogenic) Bacteria.—Micrococci have been found in Suppurative Diseases (Pyæmia, abscesses); Scarlet Fever; Small-pox; Puerperal Fever; Erysipelas; Gonorrhœa (a coccus is found dividing in two directions—*Merismopedia*—adhering to the pus-cells, and it is claimed that pure cultivations were inoculable); Pneumonia (the so-called *Pneumo-coccus*, certainly inoculable into mice, which died): Spirilla, in Relapsing Fever and Cholera asiatica: Bacilli, in Leprosy; Typhoid; Plague; Tuberculosis; Anthrax; Glanders; Tetanus.

Generally, these visitants are not long sojourners, although there are such notable exceptions as the bacilli of tubercle and of leprosy. Either the patient or the microbe soon gets the upper hand. In the former case a more or less lasting immunity becomes established, as I shall explain presently. Adhering to my original intention, I prefer to give you some leading points about two most interesting cases of infectivity rather than to run rapidly through the whole scale. The two cases which I select are cholera and tuberculosis, of which latter consumption is a particular and the most important case. These two diseases stand at the extremes of duration, cholera carrying off its victims in a few hours, while in consumption man plays a long-drawn but too often losing game of months or years. Yet they have this in common, that they are amongst the "grim reaper's" most stalwart henchmen. They slay their hecatombs: cholera over small areas quickly, with remissions or intermissions; consumption over nearly the whole inhabited world, slowly, but without halting. They have this other fact in common, that we owe it to the same distinguished scientist, Koch of Berlin, to have discovered their respective microbes.

Cholera.—The *Spirillum choleræ-asiaticæ* is often called Koch's comma bacillus, because individual cells, being only small sections of a spiral, have that appearance when detached from one another. Sometimes, however, they remain connected, and the truly spiral structure becomes manifest. It is a great air-lover in what may be called its natural state, and exerts its very free powers of movement to get to it. This is one of the bacteria of which we can say for certain that it lives two lives—one a non-parasitic, or saprophytic (σαπρόν, decayed or dead matter), and also aerobic; the other a parasitic and anaerobic. In water which contains plenty of organic matter it can live and multiply. Such a condition is supplied by the waters of the Ganges at its mouths. Here is plenty of warmth and plenty of organic matter,

which accumulates through a certain degree of stagnation caused by the impediment of the tides. The delta of the Ganges is looked upon as the home of cholera, and there it is to be found all the year round. Since the introduction of a good water supply to Calcutta, cholera has been reduced there 60 per cent. In another great delta, that of the Yang Tze at Shanghai, cholera is also endemic, but it is not present all the year round as at Calcutta. It comes regularly after two months of hot summer. This points to the soil temperature as an important factor. It is true that the temperature of the soil at some depth does not reach its maximum till after the atmospheric maximum is reached. The cholera spirillum is not difficult to cultivate. When grown in peptonised gelatine, *especially when free oxygen is excluded*, it generates a very deadly alkaloid, which will produce in animals some of the characteristic symptoms of cholera. When the spirillum can get a footing in the intestines, and the soil is not unfriendly, it takes up its abode there, getting into the secretory crypts, and even beneath the epithelium of the mucous membrane, but not, it appears, into the blood-stream or internal organs. Yet to get to the intestines it must pass the barrier of the stomach, and as it cannot stand acids, it would appear to have a poor chance of getting to the intestines, whose contents are alkaline. Yet that it does only too often reach the intestines alive indicates that it does so either while gastric digestion is in abeyance or the stomach in an unhealthy state. Certain it is that persons who have got the cholera have often been previously suffering with dyspeptic symptoms. Although cholera does not appear to be catching from one to another in the ordinary way, as small-pox and scarlet fever are, it is nevertheless indirectly catching. The people who wait upon the patient, or who bury him when dead, do not often catch the disease, while the person who washes the soiled garments later on may do so. The explanation offered is this: during the day or so which elapses before the articles are washed they have been living a non-parasitic life, and have become hardier than the pampered race which have been living a parasitic life, and have thus become hardier and better able to force their way into a new host.

Tuberculosis.—The tubercle bacillus was discovered in 1883 by Koch. It is a slender rod from $\frac{1}{17000}$ to $\frac{1}{8000}$ inch long and about $\frac{1}{75000}$ wide. It has not been found as yet free in nature, that is to say, so far as we know it is a pure parasite; but after a great deal of trouble a way has been found to cultivate it artificially. It is not motile, and is very slow growing. When it finds its footing in a living body it does not travel with the blood-current like anthrax, nor swarm in the intestine like cholera, but takes up its abode in the solid tissues, there setting

up certain changes which are known by the name of tubercle. Now, although the tubercle bacillus is so slow of growth, and does not readily gain a footing, it is very tenacious of its powers of vitality. This is partly due to its formation of spores. The expectorations of consumptives are infectious even after drying. It is recognised that phthisis is apt to cling to certain houses, and one need not wonder that it should if one considers the dirty habits of some of the inhabitants—of some even who would be surprised if charged with being dirty. Yet the extensive use of heavy hangings and thick-piled carpets, though eminently respectable, is essentially dirty. Consumptive patients should be taught to spit into water, or into some substitute for pocket-handkerchiefs which can soon be burnt. Cattle are very prone to tuberculosis—it appears to be increasingly so—and there is a very general inference that the flesh and milk of affected beasts should not be used. The milk appears to me to be a greater source of danger than the meat, for the latter is not taken raw, while milk is commonly so taken; moreover, the tuberculosis is an affection of lungs, glands, and serous surfaces, and easily recognised. But I am sceptical myself if tuberculosis is at all frequently inoculated in this way. Consumption of the lungs, far and away the most important among tubercular diseases, is certainly not got by feeding. There remain abdominal tubercle and more or less generalised tuberculosis to be accounted for, and it seems to me that the chain of cause and effect here is with extreme rarity complete. A point of interest is that out of the vast number of people who are exposed to tubercular infection, a comparatively small number develop the disease; the bacilli cannot get a footing. There is a struggle going on between the tissues and the organisms for mastery. When the tissues are in a healthy and vigorous condition they are better able to combat the bacilli. On the other hand, when the bacilli can find, particularly in the lungs, a resting-place where they can grow for a while and thus muster their forces, possibly secreting some compound which depresses the vitality of the surrounding tissues, they have a better chance of presently carrying on a successful invasion of the same. Light kills the bacilli. If the belief of some is true, that the bacillus has a non-parasitic phase of life, then the value of light in and about dwellings is extremely great.

Immunity.—This subject is still very much in the workshops. We are only able to see the seamy side, and there is much apparent confusion. We all know that in most infectious diseases one attack more or less protects from a subsequent one. It is very easy to theorise about this, but very hard to find the key to it. One notion was that the microbes used up something in the system, and that the system never, or only after a longer or shorter interval, was able to make up this lost factor.

But it was never possible to demonstrate the existence of this substance. Moreover, some diseases do not protect against themselves, or even are more prone to return, and yet run their course and die out. Another theory was that the bacteria added something to the system which not only killed them, which we know is the case among saprophytes, but, remaining in the system, prevented any future invasions. But here again no analysis could find the substance. Another theory is more tangible. It is known that the bodies described as leucocytes and white-blood corpuscles incorporate foreign bodies, and it has been shown in experiments upon animals that the living cells do swallow the bacteria. This is Metschnikoff's theory of *Phagocytosis.* He considers that the corpuscles by practice acquire this power of swallowing and destroying bacteria; that they always do so during the convalescence from infectious diseases; but that till they have thoroughly "learnt the trick" they cannot keep down the invading bacteria. This theory supposes that the work once learnt is handed down from one generation of corpuscles to another. The old pathological schools are at the present day represented in this question of immunity: the "solidists" holding that it is the living tissues of the body which, in exercise of their subtle vigour, act the part of a defending army; the "fluidists" maintaining that the serum of the blood has a bactericidal action. In any case we must come fundamentally to the living body-cells, which are responsible for the composition of this serous medium.

117.—Some Surrey Wells. (Second Paper.)

By W. Whitaker, B.A., F.R.S., F.G.S., Assoc. Inst. C.E.

(Read November 20th, 1894.)

Of the following sections the only one calling for particular notice is at East Horsley, where the Chalk has been pierced from top to bottom, from the Tertiary beds above to the Upper Greensand beneath. Only in two other places in the county had this happened before, at Richmond and at Streatham. But whereas in those sections the Chalk is about 670 and 623 feet thick, at East Horsley it is over 817, an increase of 147. The Earlswood boring, throughout in Wealden beds, is also notable on account of its depth; and the Richmond well because it is the first experiment in driving a great length of galleries in the Chalk beneath a great thickness of Tertiary beds, that thickness varying from 250 to 300 feet; whereas in other places no such extensive work has

been done under anything near 200 feet of Tertiary beds, and rarely under as much as 150.

Before describing the sections it may be well to give a list of those already noticed, and in this one need not always refer to the original sources, such as papers by Prof. Prestwich and Mr. Lucas, but, more conveniently, to the two Geological Survey Memoirs, in which previous publications of well-sections are included, sometimes with additions, and always with acknowledgment of the original authority.

The first reference, then, is to vol. iv. of the Memoirs, "The Geology of the London Basin, Part I," 1872, in which 83 Surrey wells, at the following places, are described (pp. 537–563):—

Ash, Bagshot, Balham Hill, Barnes, Battersea (2), Bermondsey (12), Camberwell (3), Caterham, Chertsey, Chobham, Clapham, Croydon (2), Dulwich (2), Egham (wrongly put under Berks), Esher (?3), Farnham, Forest Hill, Garrett, Horsleydown, Kingston (5), Lambeth (9), Lower Morden, Mitcham, Mortlake (2), Norwood, Old Kent Road, Peckham, Penge, Richmond (4), Rotherhithe (3), Southwark (3), Stockwell Green (2), Streatham, Sutton, Sydenham, Vauxhall, Wandsworth (4), Wimbledon (4).

In my former paper ('Transactions' for 1886) the following 51 were added, with further information on three of the Bermondsey wells noted in the above:—

Anerley, Bermondsey (5), Brookwood, Caterham, Chelsham, Chertsey, Coulsdon, Croydon (2), Denbies, Egham, Epsom (2), Fetcham, Forest Hill, Frimley, Garrett, Guildford, Hatchfold, Lambeth (3), Leatherhead, Malden (2), Merton, Mitcham (2), Norwood, Old Kent Road, Peckham (3), Reigate, Richmond, Southwark (2), Streatham, Thames Ditton, Thorpe, Tooting, Vauxhall, Walworth, West Molesey, Wimbledon (2), Worcester Park.

In a second Geological Survey Memoir, "The Geology of London and of Part of the Thames Valley," published in 1889, many of the sections in both of the above were reprinted, sometimes with additions, and many other Surrey sections were added (vol. ii. pp. 183–239), the latter being at the following places, and adding 86 to the list:—

Barnes, Battersea (2), Bermondsey (3), Camberwell (2), Dulwich, Egham, Ewell, Garrett (3), Hook, Leatherhead, Merton (2), Mitcham (24), Southwark (2), Streatham (4), Sutton, Tooting (24), Wandsworth (4), Wimbledon (9).

Besides these there are two sections which, not coming within the area described in the last Memoir, have not been reprinted; one at Ash (Rev. A. Irving, Proc. Geol. Assoc. vol. ix. p. 415), and the other at Bletchingley (Spon's 'Water Supply,' ed. 2, p. 213).

In the Memoir on "The Geology of the Weald" there are

details of a well-section at Redhill and notices of wells at Wracklesham and Merstham (pp. 101, 142, 148).

There are, therefore, published accounts of 225 well-sections in the county (83+51+86+5), and this paper adds 32 more (besides some further information as to two published sections), bringing up the total to 257.

In the following sections the figures stand for feet, unless otherwise stated.

[Words in square brackets have been added by the writer.]

Addington. *Croydon Waterworks.* 1885–1888.

An account of the work has been given to the Society by Mr. E. Lovett. See Trans. 1889, pp. 152–154.

Communicated by Mr. T. Walker, Borough Engineer.

$318\frac{3}{4}$ feet above Ordnance Datum.

Shaft 200 feet (3 feet filled up with concrete), with a short boring. Galleries, in various directions, at 116 to 122, and $132\frac{1}{2}$ to $142\frac{1}{2}$. [In these there were almost dry parts, sometimes for a long way, between springs.]

Water-level about 68 or 69 feet down.

Supply in 1893, at the rate of 777,000 gallons a day.

		Thickness FT.	Thickness IN.	Depth FT.	Depth IN.
Earth [soil, &c.]		5	6	5	6
Flinty Chalk.	Chalk, with 7 layers of flints	28	6	34	0
	Hard brownish chalk rock	1	0	35	0
	Chalk, with five layers of flints	20	5	55	5
	Open bed, with flint (water first found)	3	0	58	5
	Open chalk	5	6	63	11
	Close bed and flints	2	4	66	3
	Close chalk	6	5	72	8
	Watery open flint bed	2	3	74	11
	Chalk, partly open, mostly close, partly with flints, with some layers of flint (one at the bottom, a foot thick, beneath which no more was found)	77	1	152	0
Flintless Chalk.	Close bed, and then plum-pudding chalk, with 3 inches of bine [marl?] at the base	5	0	157	0
	Close bed	12	0	169	0
	Curly chalk [? irregular curved jointing], with two layers of bine [marl?]	31	0	200	0

[All the Chalk presumably belongs to the Upper division, the flintless character of the lower part being a local accident, probably of no very great horizontal extent.]

Bermondsey. *Park Street. Messrs. Bowron's.*

Boring made and communicated by Messrs. Isler & Co. Plentiful supply of water.

		Thickness FT.	Thickness IN.	Depth FT.	Depth IN.
Dug well (the rest bored, 7¼ inches diameter)		—	—	7	6
[? Alluvium and River Drift.]	Blue clay	8	6	16	0
	Gravel	13	0	29	0
[London Clay, 67½ feet.]	Clay	37	6	66	6
	Sandy clay	9	0	75	6
	Clay	17	10	93	4
	Green sand [? Basement-bed]	3	2	96	6
[Woolwich and Reading Beds, 33 feet.]	Clay	5	0	101	6
	Mottled clay	8	0	109	6
	Clay	3	6	113	0
	Sandy clay	6	6	119	6
	Clay	4	6	124	0
	Mottled clay	5	6	129	6
[? Woolwich and Thanet] Green sand		29	6	159	0
[Thanet] Sand		28	6	187	6
Chalk		163	0	350	6

Chertsey. *A second well* (1888) *at the Brewery.*

(Account of first well published in the 'Transactions' for 1886, p. 49.)

Bored and communicated by Messrs. Isler.

		Thickness	Depth
Made ground		5	5
[River Gravel.] Ballast		28	33
[Bagshot] Sand		17½	50½
[London Clay, 361½ feet.]	Sand and blue clay [? passage-beds]	23½	74
	Blue clay; with claystone at 155-156, claystone and pebbles at 179–180, claystone and pyrites at 195–197 and 240–242, and claystone at 384–385	338	412
[Reading Beds, 104 feet.]	Green sand	15	427
	Mottled clay	30	457
	Brown loamy sand	18	475
	Sand and water	15	490
	Brown clay	15	505
	Green sand	11	516
Chalk		304	820

Chilworth. *Franciscan Noviciate.* 1892?

Made and communicated by Messrs. Legrand and Sutcliff. Water-level 114 feet down.

		Thickness	Depth
[Lower Greensand.]	Sand and ironstone	65	65
	Loamy sand	56	121
	Hard sand	3	124
	Loamy sand and ironstone	31	155

Cranleigh. *Wethersal Grange.*

Bored and communicated by Messrs. Duke and Ockenden.

[Weald Clay.]	Old well, the rest bored	43	98 feet.
	Hard clay, no water	55	

Croydon. *Gas-works, Waddon. Second well, about* 300 *yards southward of the other.* 1890.

Made and communicated by Messrs. Legrand and Sutcliff. Water rising to 5 feet below the ground. Supply ample.

		Thickness	Depth
Pit (gravel)		—	7
[Woolwich and Reading Beds.]	Stony clay	3	10
	Hard clay	7	17
	Plastic clay	4	21
	Sand and pebbles	9	30
[? Woolwich and Thanet Beds.]	Blowing sand	11½	41½
	Black sand	19	60½
	Sandy silt	13½	74
Chalk and flints, with a vein of sand at the depth of 102–102¼		210	284

In the older well the depth to the Chalk is 108¾ feet, or more than 34 in excess of the above, showing a southerly rise of about 1 in 26.

Trial-boring for the Lambeth Water Company, next the Reservoir at Selhurst. 1891.

218·2 feet above Ordnance Datum.

Made and communicated by Messrs. Docwra; with some particulars from a report by Mr. R. Etheridge, communicated by Mr. S. H. Loutitt, Secretary to the Company.

Water-level 119 feet down.

		Thickness	Depth
[London Clay.]	Yellow clay [? also gravel and sand, according to Mr. Etheridge] ...	$16\frac{1}{2}$	$16\frac{1}{2}$
	Stones [pebble-bed, according to Mr. Etheridge]	$\frac{3}{4}$	$17\frac{1}{4}$
	Coloured clay..............................	$11\frac{3}{4}$	29
	Blue clay	30	59
	[Basement-bed.] Sand	2	61
	[Basement-bed.] Grey stone, with shells	$1\frac{3}{4}$	$62\frac{3}{4}$
[Oldhaven Beds.]	Fine sand	12	$74\frac{3}{4}$
	Clay, with stones and shells [thin pebble-bed, according to Mr. Etheridge]	$\frac{1}{4}$	75
[Woolwich and Reading Beds, $42\frac{1}{2}$ feet.]	Black clay [dark grey, Etheridge]; shells and stone mixed...........	14	89
	Mottled clay	$15\frac{1}{2}$	$104\frac{1}{2}$
	Green sand and pebbles	6	$110\frac{1}{2}$
	Green sand..............................	6	$116\frac{1}{2}$
	Pebbles, very hard	1	$117\frac{1}{2}$
[Thanet Sand, $47\frac{1}{2}$ feet.]	Very hard sand	$12\frac{1}{2}$	130
	Sand, not so hard	15	145
	Sand	15	160
	Black sand, like clay	4	164
	Flints	1	165
Chalk, with flints [hard bed at 271–295, according to Mr. Etheridge]		305	470

At 177 feet the yield was 250 gallons an hour.
,, 207 ,, ,, ,, 550 ,, ,, ,, or 13,200 a day (3 inch pump).
,, ,, ,, ,, ,, 1070 ,, ,, ,, or 25,680 a day.
,, 228 ,, ,, ,, 2520 ,, ,, ,, or 60,480 a day (6-inch pipe), after boring to 420 feet.

East Horsley. *The Towers, just outside the garden-wall, north of the house.* 1886.

? About 300 feet above Ordnance Datum.

Made and communicated by Messrs. Legrand and Sutcliff [and from specimens].

Water (in chalk) rose to 105 feet from surface. Fell on reaching U. G. S. (to 117 feet). Practically no supply of water until over 400 feet deep, when the water-level rose several feet. A further sudden rise in the water-level has twice taken place since, and each time accompanied by a practical increase in the yield, so that we now (March, 1886) can get over 1000 gallons an hour without lowering the head of water more than 25 feet (526 feet deep).

		Thickness	Depth
	Dug well [partly gravel]	—	13
[Thanet Sand (top three beds rather doubtful), ? 20 feet.]	Clay [light brown sand]	8	21
	Sand and clay [sand, with green grains and bits of brown clay]	2	23
	Clay [brown sand, with clay]	2	25
	Sand [fine, buff]	5	30
	Mottled clay [brownish and buff sand]	1	31
	Flints [green-coated]	2	33
Chalk, 817½ feet.	White chalk and flints	236	269
	Putty chalk and flints	99	368
	Marly chalk	4½	372½
	Hard chalk and flints [ordinary white chalk]	41½	414
	Very hard chalk [hard cream-coloured chalk]	159	573
	Granular chalk [a sort of loose chalk-grit]	20	593
	Marly chalk and hard bands [hard cream-coloured marly (?) chalk]	12	605
	Grey chalk [white]	51	656
	Marly chalk and hard bands [hard cream-coloured chalk]	20½	676½
	Hard grey chalk [greyish]	31	707½
	Chalk marl [compact, firm, grey]	143	850½
Upper Greensand (& Gault ?).	Upper Greensand [compact greenish sand, calcareous ?]	17½	868
	Gault [friable sandstone of U. G. S.; clay said to have been found also]	6	874

Epsom. *Waterworks, New well.* 1889.

In the same yard as the older wells, but nearer the road (between the stables and East Street).

A boring of 18 inches diameter, made and communicated by Messrs. Tilley; with some particulars from a Report to the Local Board, by Mr. G. Hodson (1894).

When made this bore-hole was tested to 13,000 gallons an hour; but it is said that 20,000 gallons an hour are regularly pumped, and that once this quantity was got continuously for 42 hours, when the flow of water was still enough to gain on the pumps. The supply of the town is now chiefly got from this boring.

		Thickness	Depth
	Mould	2½	2½
	Gravel	3	5½
[Reading Beds, 19½ feet.]	Clay	7	12½
	Fire-clay	2	14½
	Green sand	9	23½
	Oyster-shells	1½	25
[Thanet Sand, 31 feet.]	Dark sand	29½	54½
	Sand and flints	1½	56
	Chalk	? 224	280

Farnham. *Mr. W. Barling's.*

Made and communicated by Messrs. Legrand and Sutcliff. Water-level 15 feet down.

		Thickness	Depth
	Dug well, the rest bored	—	63
	Pipes driven (no record of the beds)	—	92½
[Lower Greensand.]	Sand	9½	102
	Yellow sand	2	104
	Sand	26	130

Waterworks. 1885.

Boring, communicated by Messrs. Legrand and Sutcliff.

		Thickness	Depth
	Made ground	2	2
[Drift, 16 feet.]	Loamy sand	11½	13½
	Light ballast and loamy clay	4½	18
[Gault, 152 feet.]	Grey clay	1	19
	Black gault	59	78
	Gault, with thin layers of green sand	2	80
	Gault and stone in places	50	130
	Sandy gault, with 4 inches of stone at 160 feet	40	170
[Lower Greensand, 187½ feet.]	Dead grey sand, with layers of green	10	180
	Live green sand, with stones	10	190
	Live green sand (darker)	59	249
	Live green sand, cleaner and more lively	88	337
	Hard coloured dead sand, with small stones	20½	357½

Frimley. *Mytchett Place.*

Made and communicated by Messrs. Legrand and Sutcliff. Water-level 66 feet down.

		Thickness	Depth
[? Up. Bagshot & Bracklesham Beds ?]	Dug well, the rest bored	—	36
	Sand	26	62
	Clay and sand	18	80
[Lower Bagshot ?]	Sand	152	232
[London Clay ?]	Clay and pebbles	8	240
	Blue clay and sand	24	264
	Green sand [? colour from dampness]	23	287
	Marl and clay	8	295
	Clay	17	312

This is another version of the section given by the Rev. A. Irving, and reprinted, with remarks, in my first paper on Surrey

Wells ('Transactions' for 1886, pp. 53, 54). The above classification of the beds seems more warrantable than that given before.

Godalming. *Messrs. Pullman's, Leather Dressers.*

Made and communicated by Messrs. Duke and Ockenden.
Good supply of water, rising to within 9 inches of the ground.

		Thickness	Depth
	Made up ground	12	12
[River Drift.]	Gravel, fine and coarse	8	20
[Hythe Beds.]	Yellow-brown sand	10	30
	Blue-grey sand	14	44
	Stiff blue clay	2	46
	Blue-grey sand	7	53
	Medium hard sandstone	7	60
	Bluish clayey sand	12	72

Not far S.W. of Cateshall Mill.

From information given by Mr. Sweetapple.
According to information got by Mr. C. E. Hawkins this was made some fifty years or more ago, and was unsuccessful.

		Thickness	Depth
[Lower Greensand.]	Coarse sand	12	12
	Stones and sand	38	50
[Atherfield & Weald.]	Clay (the latter part sandstone)	490	540

According to a letter from Mr. J. Church, at the Godalming, Frith Hill, and Farncombe Waterworks, a large fissure was cut in rock, which runs under Frith Hill, and an unlimited supply was got from this source. When more than 10,000 gallons an hour are pumped, sand is got with the water.

Godstone.

Two Wells. Made and communicated by Messrs. Legrand and Sutcliff. 1888.

1. *Cottages in Hart Lane.*

Water-level 15 feet down.

	Thickness	Depth
Dug well (old, the rest bored)	—	45
Weald clay	58	103
Hard clay and a little sand	7	110
Hard clay	26	136

2. The Homestead, about a quarter-mile S.E. of the Green (Mr. T. Churchill, Builder).

Water-level 66½ feet down.

		Thickness	Depth
Dug well (old, the rest bored)		—	66½
[Lower Greensand.]	Dark clay and sand	13	79½
	Dark green sand, with bands of sandstone	8	87½
	Green sand and clay, and bands of sandstone	10½	98

Hambledon. *Furze Hill. Mr. Muir's.*

Communicated by Messrs. Duke and Ockenden.

[Lower Greensand.] Ferruginous sand, 75 feet.

Horley. *Elm Cottage (Mr. L. Miller's).*

No supply.
Communicated by Messrs. Isler & Co.

[Weald Clay.]	Shaft	42	67
	Bore, through blue slaty marl	25	

Rede Hall. Mr. Tebbs.

Bored and communicated by Messrs. Duke and Ockenden.
Abundance of water, rising 3½ feet above the ground.

		Thickness	Depth
Well (? old), the rest bored		—	47
[Weald Clay.]	Soft blue rock	32	79
	Hard rock, with veins of clay a few inches thick	66	145
	Softer strata, with sand	5	150

Mr. Topley has noted that a boring made at the Railway Station (about 1839) is believed to be 260 or 270 feet deep, and that water overflowed to the height of 20 feet.

Milford. *Messrs. Rothwell's Steam Dairy.*

Made and communicated by Messrs. Duke and Ockenden.
Good supply of water, coming in at various depths, and standing 8 feet down.

[? Hythe Beds.] Sandstone-rock, sometimes very hard, in layers, 40 feet.

Mitcham. *Schools.*

Made and communicated by Messrs. Tilley.

To chalk,	213	221
Chalk,	8	

Mortlake. *Brewery.*

Further work has been done at this brewery by Messrs. Docwra, who have communicated the following particulars:—

Shaft and cylinders (of newer well) carried down to 210 feet, with a heading to old boring at 105 to 110. A fissure at 284½ feet.

Water-level, February, 1890, 94¾ feet down; 18th September, 1890, about 129; 19th January, 1891, 77.

		Thickness	Depth
[London Clay.]	Blue clay [top beds omitted]	—	to 164½
	Sandy blue clay	20½	185
	Sand	1	186
	Clay stone, the bottom 2 feet light coloured	3	189
	Sand	1	190
[Reading (& ? Thanet) Beds.]	Mottled clay	30	220
	Clay and sand (water)	1	221
	Very sticky clay	23	244
	Pebbles	1	245
	Green sand	12	257
	Dark sand	15½	272½
[Upper Chalk.]	Chalk, with flints at 305 to 305½	45½	318
	Hard chalk and flints. Water at 369½ (? then softer chalk)	82	400

Nine Elms. *Messrs. Thorne's Brewery,* 27 *Nine Elms Lane.* 1892.

Made and communicated by Messrs. Isler & Co.

Water-level 54 feet down. Yield a barrel in 54 seconds.

		Thickness	Depth
Dug well (the rest bored, 8½ inches diameter)		—	12
[Deep hollow of River Drift ?]	Ballast	10	22
	Sand and stones	13	35
	Blowing sand	5	40
	Sand and stones	19	59
	Ballast	35½	94½
[Woolwich and Reading Beds, 78½ feet ?]	Sand, clay, and shells	15½	110
	Mottled clay	27	137
	Mottled clay and sand	13	150
	Clay, stones, and shells	4	154
	Reading Beds [? clay]	6	160
	Mottled clay and pebbles	6	166
	Congealed ballast [pebbles]	7	173

		Thickness	Depth
[Thanet Sand.]	Green and grey sand	35	208
	Green-coated flints and grey sand	4	212
Chalk and flints		139	351

A shorter version appeared in 'Engineering,' vol. liii. p. 776 (24th June, 1892).

There is doubt as to the above classification. One would expect London Clay, and would be inclined to put this to the depth of 150 feet. It is hard, too, to believe in so great a thickness of River Drift as 94 feet.

Norwood. *Brewery Co., Chapel Road, West Norwood.* 1889.

Made and communicated by the Aqueous Works and Diamond Rock-boring Co.

Water-level 133 feet down. Yield, 1400 gallons an hour.

			Thickness FT.	Thickness IN.	Depth FT.	Depth IN.
Old well (the rest bored)			—	—	21	0
[London Clay.]	Blue clay		153	6	174	6
	[? Basement-bed, about 4 ft.]	Black pebbles	2	3	176	9
		Oyster-shell rock	0	6	177	3
		Pebbles and dark sand	1	2	178	5
[Woolwich and Reading Beds, about 52½ ft.]	Sand		8	0	186	5
	Blue clay and shells		5	5	191	10
	Brown sand		7	5	199	3
	Oyster-shell rock		4	8	203	11
	Sand and shells		1	9	205	8
	Coloured [mottled] clay		17	10	223	6
	Pebbles and sand		7	6	231	0
[Thanet Sand, 38 ft.]	Grey sand		33	9	264	9
	Flints		4	3	269	0
Chalk and flints			82	0	351	0

Perhaps the sand at the top of the Woolwich Beds, with the pebbles, &c., classed as basement-bed of the London Clay, may belong to the Blackheath Beds.

An account communicated by the Company differs much in details (? another well), being as follows:—

Water-level 211 feet down. Rather a large quantity of iron was found in the water at first, and was attributed to the new pipes that were used. The quantity has lessened since.

		Thickness	Depth
[London Clay.]	Brown clay	10	40
	Blue clay	180	220
	Pebbles [? Basement-bed]	5	225

		Thickness	Depth
[Woolwich and Reading Beds, 39 ft.]	Red shells	1	226
	Brown dead sand	10	236
	Shells and blue clay	1	237
	Coloured mottled plastic clay	15	252
	Brown clay and pebbles	6	258
	Green sand	6	264
[Thanet Sand, 32 ft.]	Coloured sand, very hard	10	274
	Thanet sand, with water	20	294
	Flints	2	296
Chalk and flints		57	353

Nutfield. *The Spotted Cow, N. of the village.*

From Mr. W. Topley's notes.
Through gault at 124 feet.

Peckham. *High Street, for Messrs. Jones & Higgins.* 1893.

Made and communicated by Messrs. Baker.
25·3 feet above Ordnance Datum.
Shaft to the Chalk; the rest bored.
Water-level 28 feet below the road-level. Supply tested with an 8-inch pump, which lowered the water only 3 feet, and the original level was recovered in 10 minutes.

		Thickness	Depth
Road-level to basement-level		—	11
[River Drift.]	Loam and ballast	3	14
	Light [-coloured] ballast	5	19
[Woolwich and Reading Beds, 41 ft.]	Silt	8	27
	Yellow clay	10	37
	Sandy clay	1	38
	Green clay and pebbles	3	41
	Oyster-bed	1	42
	Pebbles and green sand	4	46
	Grey sand	4	50
	Black pebbles	10	60
[Thanet Sand, 33 ft.]	Brown sand	22	82
	Dark sandy clay	10¼	92¼
	Green-coated flints	¾	93
Chalk		83½	176½

Penge. *London and Provincial Steam Laundry, Green Lane, on the northern side of the L. C. & D. Railway, about half-way between Penge and Kent House Stations.* 1892.

Communicated by Mr. E. Turner. The section also from Messrs. Baker.

Bench-mark 93·4 feet above Ordnance Datum.

Cylinders (20 feet) and shaft to 74 feet; cement-bottom up to 62 feet; the rest bored, 12 inches diameter, pipe up to 48 feet.

Water rose to the surface.

		Thickness	Depth
Mould		1	1
[River Drift] Gravel		1	2
[London Clay, 73 ft.]	Yellow clay, rotten	11	13
	Loam	21	34
	Sandy clay	4	38
	Blue clay	35	73
	Sandy clay	2	75
[? Blackheath Beds.]	Light grey sand	5	80
	Pebbles and sand	5	85
[Woolwich and Reading Beds, 32 ft.]	Petrified timber [? lignite]	3	88
	Grey sandy clay	2	90
	Shelly beds	11	101
	Coloured [mottled] clay	1	102
	Shelly rock	1½	103½
	Sandy clay	½	104
	Coloured [mottled] clay	5	109
	White marl	6	115
	Pebbles	2	117
Thanet Sand		1	118

Date.	Hours pumped.	Water lowered (ft.)	Water rose (ft.)
June 27	6 (12 to 6)	29½	14 in 12 hours.
,, 28	11 (7—6)	32 down to 48	28½ ,, ,,
,, 29	6 (7—1)	28 ,, ,, 47	3½ (from 1 to 2).
	Started again at 2	1 ,, ,, 48	28 in 12 hours.
,, 30 / July 1	9 (7—1, 2—6)	,, ,,	,, ,, (3½ in interval).
,, 2	8 (7—3)	46 ,, ,, 66	63 in 40 hours.
,, 4	8 (8—1, 2—6)	,, ,, 64	30 ,, 14 ,, (3½ in interval.)

Pump, of 6 inches diameter, 15-inch strokes, averaged 17 strokes a minute.

Red Hill. *Royal Asylum of St. Anne's Society.*

Made and communicated by Messrs. Docwra.
Shaft 48½ feet; the rest bored.
Water-level 34 feet down.

		Thickness	Depth
[Lower Greensand.]	Sand	48	48
	Black sand	12	60
	Sand	52	112

Reigate. *Waterworks, in the valley S.W. of the town. Trial-boring.* 1868.

Communicated by Mr. F. S. Courtney (Easton & Anderson).

		Thickness	Depth
[Hythe Beds of Lower Greensand.]	Yellow running sand and water ...	60	6
	Loamy yellow sand	23	83
	Live yellow sand and water	3	86
	Loamy yellow sand	9	95
	Live yellow sand and water	21	116
	Dark sand and a little water	36	152
[? Atherfield Clay.]	Brown clay	6	158
	Green sand	41	199
	Blue clay	8	207

In 1870 a well, lined with cylinders, was sunk to the depth of 68 feet, with a boring to 110. The water is said to have risen to the surface: it is discoloured, and, despite of an elaborate arrangement for filtration, the well became choked with sand, and has been abandoned.

In 1890 an average of 133,204 gallons a day was pumped in July, of 131,213 in August, and of 140,407 in September.

Reigate. *Earlswood Asylum.* About 1862 or 1863.

Information got by Mr. C. E. Hawkins (from Dr. Grabham, the Superintendent, and from specimens). He says that there were many other specimens, not marked.

About 160 feet above Ordnance Datum.

Shaft 160 feet; the rest bored. A failure as regards water.

		Depth of Specimens
[Weald Clay.]	Stiff clay	4
	Brown and pink mottled clay	50
	Clay, with thin seams of sand	93 ?
	Hard shaly clay, with shells	120
	Clay	200
	Stiff clay	300
	Hard ferruginous clay, with shells	408
	Clay, with traces of shells	413
	Very stiff purplish mottled clay	415
	Clay, with traces of a decomposing salt	461
	Clay, with traces of small shells (not Cyprides)	465
	Clay, with traces of a decomposing salt	468
	Stiff clay	470 B
	Sandy clay	470 A, 472, 473 and 474
	Shaly clay	478
	Pinkish mottled clay	480
	Greenish and purplish mottled clay, a little shaly	481
	Sandy clay	486
	Clay, a little shaly	487
	Shaly clay	488, 490, 495 and 497
	Clay	498
	Shaly clay	512
	Clay	513
	Clay ?, sandy ?	518
	? Sandy	534
	Shaly clay	53– ?
	Clay	536

		Depth of Specimens
[? Weald Clay or Hastings Beds.]	Fine clayey sand	538
	Bluish sandy clay	541
	Clay	553
[Hastings Beds.]	Fine sand	583, 586, 603, 611 and 612
	Fine sandy clay	700 and 744
	Sandy clay	760
	Clay less sandy than the above	765
	Very fine sand	773
	Clay	785
	Very sandy clay, fine	832
	Clay (plastic when wet?)	833
	Very fine sandstone	845, 876, 886 and 910
According to Messrs. Baker, who made the boring, the depth is		912½

As there are sometimes considerable gaps between the specimens, it is difficult to classify the beds. The Weald Clay seems to go down to 553 feet, and the Hastings Beds may begin at 583. On the other hand, it is possible that the Weald Clay may reach deeper down (? to 833 feet), though this would give an excessive thickness to the formation. Under these circumstances it is clearly out of the question to attempt a division of the Hastings Beds.

Richmond. *Waterworks, Terrace Garden Well.* 1890.

Communicated by Mr. W. G. Peirce, engineer.

42¾ feet above Ordnance Datum.

Shaft 320 feet; the rest bored.

Galleries from 314 to 320 feet down, in various directions, of a total length of 4492 feet (1894), the chief one N.N.W. to the old well. Another, southward, has just touched the junction of the Tertiary beds with the Chalk at about 1000 feet from the well (as the crow flies), showing that there is a slight southerly dip. Probably some further length of gallery will be driven.

		Thickness	Depth
Mould, ashes, and brick-rubbish		3	3
London Clay, 211½ ft.	Brown clay, mottled with a little light blue, with broken and scattered clay-stones	9½	12½
	Clay, with a few fossils	82½	95
	Hard clay, with a few fossils	39	134
	Clay, laminated with partings of fine black and white sand; black flint-pebbles, and a few fossils; 4-in. clay-stone at base, with a little water under	6	140
	Hard clay, with a few sandy partings	15	155
	Very hard clay, with a few fossils	30	185

		Thickness	Depth
London Clay (continued), $211\frac{1}{2}$ ft.	Very hard dry sandy clay: clay-stone at base, with fragments of plant-remains	$12\frac{1}{2}$	$197\frac{1}{2}$
	Very hard dry sandy clay, with fossils and part of a tree-trunk (9 ft. by $2\frac{1}{2}$ in.), much bored by *Teredo*. Thin layer of black flint pebbles at the base	$16\frac{3}{4}$	$214\frac{1}{4}$
Reading Beds, $65\frac{3}{4}$ ft.	Very hard dry sandy light-coloured mottled clay	$3\frac{1}{2}$	$217\frac{3}{4}$
	Hard dark somewhat mottled clay	17	$234\frac{3}{4}$
	Very hard dry sandy mottled clay	$5\frac{1}{2}$	$240\frac{1}{4}$
	Hard mottled clay	4	$244\frac{1}{4}$
	Soft dark mottled clay	$5\frac{1}{2}$	$249\frac{3}{4}$
	Very hard dry sandy light-coloured mottled clay	$2\frac{3}{4}$	$252\frac{1}{2}$
	Hard dark mottled clay	$3\frac{1}{2}$	256
	Very hard dry sandy light-coloured mottled clay	$3\frac{1}{2}$	$259\frac{1}{2}$
	Very fine dry sandy light-coloured loam	1	$260\frac{1}{2}$
	Fine light-brown sand, slightly mottled in parts	$8\frac{1}{4}$	$268\frac{3}{4}$
	Darker coarser sand, with $2\frac{1}{2}$ in. of soft sandstone at top	$\frac{3}{4}$	$269\frac{1}{2}$
	Green sand and black sandy loam, partly with soft chalk-pebbles [concretions ?]	1	$270\frac{1}{2}$
	Green sand and black loam, partly with flint-pebbles, hard brown and light-blue mottled clay, with fruits of plants, and brown and black laminated clay	$1\frac{1}{2}$	272
	Green and grey sand, and (greater part) conglomerate of flint-pebbles, in sand and loam	3	275
	Green iron-shot sand, with many chips of flint, oyster-shells, pieces of hard chalk, and fish-teeth (in coarse greyish sand). Some rounded pieces of limestone [concretions] at the base	5	280
Thanet Sand, 10 ft.	Dark grey dry hard sand, loamy in parts, hard and clayey towards the base	9	289
	Continuous cemented layer of flint, 6 to 8 inches, with small flints under, green-coated, in hard sand	1	290

	Thickness	Depth
[Upper] Chalk. The surface smooth. The top foot bored in all directions with oval holes of all sizes up to $\frac{3}{4}$ inch diameter, some reaching a depth of over 12 feet; all filled with grey sand. Many flints, in layers $1\frac{1}{2}$ to $2\frac{1}{2}$ feet apart (with few breaks), and some between the layers: a thick continuous layer, with black clay underneath, at the depth of 389 feet	180	470

This differs from the older section in starting at a rather higher level, so that the depth to the Chalk is greater. The Reading Beds are somewhat thicker, whilst the Thanet Sand is less than half the thickness.

Vauxhall. *Bond Street. Messrs. Barrett & Co. Second well.* 1886.

Made and communicated by Messrs. Legrand & Sutcliff.
Water-level $50\frac{1}{2}$ feet below the cellar-floor.

		Thickness	Depth
Dry well (the rest bored)		—	6
Ballast [River Gravel]		3	9
[London Clay, 105 ft.]	Blue clay and septaria	69	78
	Blue clay	$34\frac{1}{2}$	$112\frac{1}{2}$
	Pebbles [Basement-bed]	$1\frac{1}{2}$	114
[Woolwich and Reading Beds, $50\frac{1}{2}$ ft.]	Mixed clay	$5\frac{1}{2}$	$119\frac{1}{2}$
	Clay and shells	$1\frac{1}{2}$	121
	Clay and sand	$5\frac{1}{2}$	$126\frac{1}{2}$
	Coloured [mottled] clay and sand	20	$146\frac{1}{2}$
	Mottled clay	$7\frac{1}{2}$	154
	Clay and pebbles	$4\frac{1}{2}$	$158\frac{1}{2}$
	Green sandy clay and pebbles	6	$164\frac{1}{2}$
[Thanet Sand.]	Grey sand	38	$202\frac{1}{2}$
	Green flints	1	$203\frac{1}{2}$
Chalk and flints		$104\frac{1}{2}$	308

West Clandon. *Woking Waterworks.* 1882.

Communicated by Mr. H. H. French, who got information from the well-sinker's foreman, and from specimens.

Water rose 10 feet above the ground, but was said not to be good. When the flints above the Chalk were broken through the water broke in and drove out the workmen. [According to a short notice in 'The Engineer,' vol. iv. p. 27, water was found at the depth of 310 feet. The supply seemed very poor in 1887.]

	Thickness	Depth
Soil	2	2
Flints and yellow loamy clay [? weathered London Clay]	5	7

		Thickness	Depth
Blue London Clay, with septaria at 16 levels (in three cases large enough to go across the well). Black loamy sand and a little water at 37 feet. A few pebbles and a little water at 128. Veins of sand at 145, 150, and 210. Shells at 176 and 226. Reddish clay at 222. A 6-inch bed of pebbles at base		224	231
Woolwich and Reading Beds, 79 ft.	Compact bed of shells and clay ...	1	232
	" " " " (whiter)	1½	233½
	Mottled clays, varying in colour (blue, red, brown, buff, &c.)	35½	269
	Mottled clays; no particulars kept, but sandy toward the base.........	31	300
	Hard loamy green sand...............	2½	302½
	Hard grey and yellow sand	1¼	303¾
	Loamy green sand, mottled brown	1¼	305
	Hard dry green loamy sand, with scattered shells, much broken ... Thin bed of small black flint pebbles.	4½ to 5	310
? Thanet Beds.	Greenish loamy sand	2	312
	Clean grey sand, full of water	2	314
	Green-coated flints	½	314½
Chalk, with occasional beds of flints....................		? 99½	414

Wonersh. *Chinthurst Lodge.* **1887.**

Made and communicated by Messrs. Legrand & Sutcliff.

		Thickness	Depth
[Lower Greensand.]	Sand	14	14
	Blue clay	12	26
	Blue sand	4	28
	Hard clay and sand.........	20	48
	Hard clay	2	50

118.—Habits and Habitats of Plants: some Remarks on Superficial Resemblances between Plants of Different Affinities.

By H. Franklin Parsons, M.D., F.G.S.

(Read November 20th, 1894.)

It must often have attracted the attention of observant lovers of plants that certain plants of a similar general appearance differ widely in their flowers and fruit; or, conversely,—since the affinities of plants are judged of by botanists from the reproductive rather than from the nutritive organs,—that plants of different families often resemble each other in habit; the word "habit" being used by botanists to express the general appearance and mode of growth. Such resemblances are often borne

witness to by the names of plants; not only in scientific terminology,—*e. g.*, the numerous specific names ending in *ides* (εἶδος, form),—but also by the popular names. Thus we have ash and mountain-ash; chestnut and horse-chestnut; nettle and dead-nettle; flax (*Linum*) and toad-flax (*Linaria*); black bryony and white bryony; alder and berry-bearing alder; purple loosestrife and yellow loosestrife: all of these belonging respectively to widely different orders.

Sometimes, however, the similarity thus noted in popular names may lie in properties or uses rather than in appearance (*e. g.*, sorrel and wood-sorrel; lettuce and lamb's-lettuce), and in other cases it is difficult to trace the resemblances which have given rise to a similarity of name: as agrimony and hemp-agrimony; violet and water-violet (*Hottonia*).

The chief reason of these resemblances of form seems to be that plants of different orders have, in the struggle for existence, betaken themselves to similar habitats—the "habitat" of a plant being the sort of place where it grows—and have adapted themselves to those habitats by acquiring forms and habits suited to their station in life; and therefore, necessarily, in many cases these adaptations of unallied plants have tended in similar directions.

Another explanation, however, may in some instances hold good. It is well known that in the animal kingdom certain species,—*e.g.*, of insects,—escape from their enemies by their resemblance to other species which are armed, uneatable, or in other respects objectionable; and it is conceivable that among plants a similar mimicry may sometimes have been brought about through natural selection, by a plant deriving benefit from its resemblance to another plant which possessed some property rendering it objectionable to herbivora and insects. Thus Sir John Lubbock suggests that the dead-nettle may be protected by its resemblance to the stinging-nettle, and the scentless May-weed (*Matricaria inodora*) by its resemblance to the strong-flavoured chamomiles. The dead-nettle, however, would seem to possess other means of protection in its strong scent and rough hairs.

The following are instances from the British flora of groups of plants belonging to different orders yet possessing a general similarity in appearance corresponding to a similar mode of life:—

1. A very striking group of plants is that of the leafless root-parasites, represented in the British flora by the species of broom-rape (*Orobanche*) and the toothwort (*Lathræa Squamaria*), belonging to the order Orobanchaceæ; by the yellow bird's-nest (*Monotropa Hypopitys*), of the order Ericaceæ; and by three species of Orchid, viz., *Neottia Nidus-avis*, *Corallorhiza innata*, and *Epipogium aphyllum*, the two latter very rare in Britain but commoner in Central Europe, specimens of the last named from Switzerland

having been shown us at a recent meeting by Mr. Mennell. These plants all agree in the absence of chlorophyll, and are hence more or less self-coloured and of a dull brown hue, ranging, however, from shades of purple to yellow; they are of a succulent nature, and the roots are few and fleshy; the leaves are reduced to mere scales; the stems are simple, except in one *Orobanche;* and the flowers are in terminal spikes. Most of these characteristics obviously depend upon the circumstance that such parasites obtain their organic constituents ready made from other plants, instead of manufacturing them for themselves by the aid of their leaves from the carbon dioxide of the atmosphere.

There is another group of plants, however, which, though partially at least parasitic on the roots of other plants, are nevertheless green and leafy. This group includes the genera *Rhinanthus*, *Bartsia*, *Euphrasia*, *Pedicularis*, and *Melampyrum*, in the order Scrophulariaceæ. It is to be remarked that in these plants the leaf area is small in proportion to the size of the plant, and that of several of them the colour is a pale yellow-green (*e.g.*, *Rhinanthus Crista-galli* and *Bartsia viscosa*). Several of them have an upright unbranched stem and flowers in terminal spikes like the leafless root-parasites. We seem to have in these genera plants more or less on their way to the mode of life which such plants as *Orobanche* have completely acquired.

It may be remarked, that of our two British aërial parasites the dodder is leafless and not green; while the mistletoe is still leafy and green, though the leaf area is small compared with many other shrubs, and the leaves are of a pale yellow-green.

2. Another type of plants inhabits the gravelly bottoms of the shores of pools, especially mountain lakes. It has narrow, stiff, quill-like root-leaves, with no stem except the scape which bears the flowers. The most characteristic plants of this habit are the following:—Awlwort (*Subularia aquatica*), Cruciferæ; water-lobelia (*Lobelia Dortmanna*), Campanulaceæ; shoreweed (*Littorella lacustris*), Plantaginaceæ; quillwort (*Isoetes lacustris*), Lycopodiaceæ. In addition to these several species of rushes and sedges may be found inhabiting similar situations and having much the same habit of growth; but in their case this habit does not differ widely from that which is general in the orders to which they belong. The four first-named plants, however, belong to widely separated orders, and differ greatly from the general habit of these orders, but resemble each other so closely that from the foliage alone it is not easy to tell them one from the other. The stout quill-like form of the leaves is doubtless advantageous in enabling them to withstand the shock of the miniature waves on the lake-shore, while they are also stiff enough to stand erect in air when the bottom of the lake is left uncovered by the water during dry seasons.

3. Plants which grow submerged in stagnant or gently running water have commonly long slender stems and leaves of membranous texture, either simple and narrow, as in the pondweeds (*Potamogeton*) and other monocotyledons, or torn into capillary segments as is more frequent among dicotyledons,—*e. g.*, the Ranunculi of the *aquatilis* section, *Myriophyllum*, *Utricularia*, *Hottonia*, and *Ceratophyllum*. *Chara* among cryptogamous plants has a similar habit. Submerged leaves are supported by the water in which they float, their buoyancy being often increased by air-cavities in their substance; hence they do not need the stiffness and strength of leaves which have to support their own weight in air; and the narrow or finely divided form, while exposing a large surface to the water for purposes of respiration and nourishment, offers less resistance to currents, and so is less liable to injury than a broad flat blade would be. The stems of these plants throw out roots freely at the nodes, and thus pieces broken off accidentally readily take root and grow in new places to which they may be borne. *Utricularia* and *Hottonia*, belonging to different orders, agree in habit in a further respect, *viz.*, that the flowering stem, which is much thicker and stiffer than the submerged stems, rises erect out of the water, like a mast on a raft, from the centre of a whorl of radiating horizontal branches. Both of these plants have conspicuous flowers, adapted to be fertilised by insects, and it is necessary, therefore, that they should be borne aloft in the air, an object which this arrangement secures.

4. Plants, on the other hand, which float on the surface of quiet waters have broad orbicular or oblong leaves, borne on long flexible stalks, and sustained like a raft by the surface-tension of the water. The flowers are commonly borne up above the water. Familiar examples are found in the yellow and white water-lilies, which belong to the order Nymphæaceæ; others are *Limnanthemum nymphæoides* (Gentianaceæ), and the frog-bit (Hydrocharidaceæ).

Other water plants, again, have leaves of two kinds, the submerged ones being narrow and finely divided, and the floating ones broad and orbicular, or oblong. Instances are *Ranunculus peltatus*, and some of the Potamogetons, especially *P. heterophyllus*. In the arrow-head (*Sagittaria*) the first submerged leaves are narrow and strap-shaped (like those of *Sparganium*, *Butomus*, *Glyceria*, and other monocotyledons); later leaves are oblong and float on the surface of the water; and the fully developed ones are acutely arrow-shaped and stand out of the water: a complete gradation being found between all of these forms.

Certain plants which float on the surface of stagnant water have their vegetative organs reduced to a mere rounded or branched frond with roots. Examples are the duckweeds; some

species of *Riccia* among the liverworts, and certain exotic Marsileaceæ (an order allied to the ferns), viz., *Salvinia* and *Azolla*, which may be seen in the Victoria Regia House at Kew.

5. Plants with long slender twining herbaceous stems and heart-shaped leaves are found in a number of different orders. As examples among plants native or cultivated in Britain, we have the two common native species of *Convolvulus* and several cultivated Convolvulaceæ, such as the *C.* (*Ipomœa*) *major;* also *Polygonum Convolvulus*, and the black bryony (*Tamus communis*), the sole British representative of the order of the yams (Dioscoreaceæ), an order in which, like the Convolvulaceæ, this habit is frequent. I might also add the French bean, in which the leaflets of the pinnate leaf are heart-shaped: and the hop, in which, though the fully developed leaves are lobed, the early leaves and those on the flowering branches are heart-shaped.

The climbing habit, a development, as Darwin has shown, of the movements of nutation common in growing shoots, enables weak-stemmed plants to get the advantage of more light and air than they would otherwise be able to obtain, by availing themselves of the support of surrounding objects; and this habit, it will be seen, has been acquired by plants belonging to a number of different orders. The heart-shaped leaf is probably the form which, under the circumstances, exposes the largest surface to the light.

6. Plants which climb otherwise than by twining have commonly palmately-lobed or divided leaves with long stalks, the stalk being at an angle to the plane of the blade. Familiar examples are the ivy, the vine, the Virginia creeper (*Ampelopsis*), the passion-flower, and the gourds (Cucurbitaceæ), including the white bryony, our solitary British representative of the order. The hop also, a twining plant, has leaves of a similar shape during its period of most vigorous growth.

The advantage of this form of leaf to plants clinging to a support seems to be that the long petiole carries the leaves well out into the air, while the broad spreading blade of the leaf is inclined at an angle which allows it to get full exposure to the light. It is to be remarked that the bushy flowering branches of the ivy, which do not cling to a support but stand out free in the air, have simple ovate leaves with short stalks, the form of leaf of the climbing shoots not being necessary or advantageous on the branches exposed on all sides to the air.

Other climbing plants have pinnate leaves, as the vetches and other Leguminiferæ; the climbing fumitory (*Corydalis claviculata*), which resembles a vetch in its habit of growth; many species of *Clematis*, and the garden plant *Eccremocarpus scaber* (nat. order Bignoniaceæ), the foliage and stem of which closely resemble those of a clematis, though the flowers are entirely different.

7. Few British plants possess peltate leaves, *i. e.*, leaves circular in outline with the stem attached in the centre like the handle of an umbrella. Such leaves are, however, possessed by two small plants growing in damp places, both having creeping stems and minute inconspicuous flowers, *viz.*, the marsh pennywort, *Hydrocotyle vulgaris* (Nat. Order Umbelliferæ), and the Cornish moneywort, *Sibthorpia europæa* (Nat. Order Scrophulariaceæ). The long leaf-stalk carries up the leaf above the surrounding vegetation, and the horizontally spreading blade exposes a large surface to the light. A similar habit is possessed by the ground ivy, *Nepeta glechoma*, belonging to the Labiatæ, which has leaves of circular outline, though not attached by the centre to the stalk.

8. Many plants growing in dry open pastures have a neat dwarf habit of growth, with a rosette of broad spreading root-leaves, a stem leafless or with few small leaves, and one or more comparatively large flowers or heads of flowers. Familiar examples of this habit are the daisy, the plantains, and the mouse-ear hawkweed; but it is especially frequently met with in the flora of mountain regions, as every one who has seen the flowers of the higher Alps will remember. The habit seems to be an adaptation to the circumstances of exposed situations, for it is adopted in such situations by plants which in richer ground or more sheltered places have tall branched leafy stems; probably by being spread out on the ground the leaves are protected from injury by the wind. Other alpine plants have narrow leaves, and grow in compact mossy tufts; and this habit, again, is common to plants of many different orders, *e. g.*, *Draba aizoides*, *Silene acaulis*, *Cherleria sedoides*, *Androsace carnea*, and several species of *Saxifraga*.

9. Succulent plants are not so prominent a feature of our British flora as they are of those of hotter and drier climates, where a fleshy habit is assumed by plants belonging to genera which in this country are represented by weeds of common character, such as *Senecio* and *Euphorbia*. Some of the tropical Euphorbiæ, indeed, exactly resemble Cacti. Our British succulent plants mostly belong to the order Crassulaceæ, with occasional representatives, chiefly maritime plants, in other orders, especially the Chenopodiaceæ.

The advantage of a fleshy habit to plants growing in dry hot situations is obvious, as it increases the volume of sap as compared with the surface for evaporation, and thus enables them to resist drying. Sedums put to dry in the press for the herbarium will often grow between the sheets of blotting-paper. The fleshy habit may similarly be useful to maritime plants in enabling them to resist injury by the salt water; but I am inclined to regard it as due in some cases to the direct action of the salt

upon the growth of the individual plant, rather than to the modification of the species by natural selection; for plants which are dwarf and fleshy when growing on the sea-coast, *e.g.*, *Glaux maritima*, *Plantago maritima*, and *Aster Tripolium*, are rank and weedy in habit when growing near the upper parts of estuaries, where the tidal water which reaches them is only slightly brackish. The presence of a large proportion of salt in the sap would promote endosmosis and impede evaporation, and thus tend to produce a swollen state of the leaf.

10. Another distinct habit of growth is that of bulbous-rooted plants. In the British flora true bulbs are hardly met with, except in the orders Liliaceæ, Amaryllidaceæ, and Iridaceæ, though an approach to a bulb is met with in some other plants, as *Ranunculus bulbosus* and *Pinguicula vulgaris*. Bulbous and cormous-rooted plants commonly flower in the spring and have linear root-leaves and a leafless flowering stem or scape. The leaves commonly follow the flowers, or, if they appear at the same time, persist after them; and they store up in the bulb a supply of nourishment from which the next year's flowers are produced. Sometimes, however, as in *Ornithogalum pyrenaicum*, the leaves precede the flowers, and are withered by the time that the latter appear. The size of the bulb seems to depend a good deal on the breadth of the leaves: thus the Crimean snowdrop (*Galanthus plicatus*), and the Siberian squill, which have broad leaves, have much larger bulbs than the common snowdrop and the *Scilla bifolia*. A few bulbous and cormous-rooted plants flower in the autumn, *e.g.*, several species of crocus, the meadow saffron (*Colchicum autumnale*), and the garden-plants *Amaryllis lutea* and *Zephyranthes candida*. All these, though belonging to different orders, have crocus-like flowers; and the *Colchicum* resembles some of the true autumn-flowering crocuses in that its leaves and seed-vessels are not produced until the following spring.

11. Instances of superficial resemblances to species not nearly related rather than to those more nearly akin may be met with among the cryptogamic orders of plants. Thus in several distinct genera we find ferns with feather-shaped fronds or leaf-organs like those of the male fern. *Polypodium alpestre* so closely resembles the lady-fern (*Athyrium filix-fœmina*), that in the absence of fructification it is all but impossibe to distinguish the two. Again, *Polypodium Dryopteris* and *Robertianum*, and *Cystopteris montana*, in their long creeping rhizomes and horizontally spreading fronds borne on long stalks, closely resemble in miniature the common brake-fern.

In several genera of fungi, as *Dædalea*, *Polyporus*, *Hydnum*, *Auricularia*, *Stereum*, &c., we find species of a leathery or corky texture growing attached by the side to trees or decaying wood, and so closely resembling one another that until the under side

is exposed to show the arrangement of the hymenium or spore-bearing membrane in gills, pores, spines, &c., it is difficult even to guess to which genus the fungus belongs. Other species in the same genera have a different form: some with a central stem; others resupinate, *i.e.*, spread out over the surface on which they grow.

Among exotic plants still more striking examples might be obtained. Thus the Cactaceæ, with their leafless succulent, often spiny stems, are counterfeited on the one hand by the Stapelias, on the other, as already mentioned, by the succulent species of *Euphorbia.*

The Cycads, palms, and tree-ferns—plants widely separated in a systematic arrangement—alike present the simple erect stem surmounted by a terminal bunch of large feathery leaves which forms so characteristic a feature in tropical forest landscapes.

But my botanical knowledge or your patience would fail, rather than the number of available examples, if I attempted to multiply instances in which plants in nowise closely related to each other, in order to fill similar positions in the physical world, have undergone adaptations on parallel lines.

119.—The Nutrition of Plants.

By W. Murton Holmes.

(Read December 18th, 1894.)

There is perhaps no subject which engrosses so much general attention as the subject of eating and drinking. Directly or indirectly the whole fabric of society is based upon the food-supply.

We are all conscious—sometimes painfully conscious—of the necessity of taking a due supply of nourishment, and we concede without question that other members of the animal kingdom have the same need. But we do not always consider that plants have similar requirements. The only idea of the average man—or woman—concerning vegetables is that they are something to be eaten, and any further thought as to nutriment ceases. Nevertheless plants work indefatigably for their living.

A living plant, whether consisting simply of a single cell or of a large number of cells in combination, takes up food from its surroundings according to its immediate needs. The method of absorption varies considerably, depending upon the nature of the nutriment, differences of habitat, requirements of particular species, and the constitution of the protoplasm in each species concerned.

If we submit a dried plant to slow combustion, with a limited supply of air, there remains a black residue, retaining in a great measure the form of the plant. This residue is charcoal or carbon, which in the living plant existed in combination with hydrogen and oxygen. Had the combustion taken place with a full supply of air so as to consume the carbon as well as the hydrogen and oxygen, a white residue or ash would have remained. The elements found in this ash, in a combined state, are potassium, calcium, magnesium, sodium, iron, sulphur, phosphorus, and chlorine, which are essential to nutrition. Besides these other elements are found in the ash of some plants, but are not considered to be essential to nutrition. The organic compounds found in plants contain the elements carbon, hydrogen, oxygen, nitrogen, and sulphur.

A well-developed living cell consists of a firm elastic membrane of cellulose closed on all sides, containing a layer of a soft substance called protoplasm in close contact with it, and itself enclosing a watery fluid called cell-sap. In most plants numerous green granules, called chlorophyll-granules, are found embedded in the protoplasm in those parts exposed to the light. The method by which a cell is able to absorb nutriment depends upon the phenomenon known as osmosis, or liquid diffusion, which may be explained as follows:—Whenever two fluids of different densities are separated by an organic membrane, there will always be a tendency to equilibrium of density between the two from the formation of a double current, one passing from the lighter to the denser, the other from the denser to the lighter. This process is repeated from cell to cell throughout the plant.

Atmospheric air consists of a mixture of 77 parts by weight of nitrogen and 23 parts of oxygen, with about 3 to 6 measures of carbonic acid in 10,000 measures of air, and also a trace of ammonia. Those plants which contain the green chlorophyll absorb the whole of their carbon, through numerous openings on the leaves called stomata, from the carbonic acid of the air. Under the influence of light the cells containing chlorophyll decompose the carbonic acid, forming other compounds with less oxygen in their composition, called carbohydrates, and the superfluous oxygen is set free. Formerly this process was regarded as an act of respiration, and was considered one of the characters by which plants could be distinguished from animals, the former absorbing carbonic acid and giving up oxygen, the latter absorbing oxygen and giving up carbonic acid. It is now known that during respiration in plants carbonic acid is given off just as in animals, but the giving off of oxygen during the process of assimilation masks the action of respiration, which can only be recognised when assimilation is at a standstill during the night. During daylight the need of carbon is very great, and a fresh

supply is being constantly worked up by the chlorophyll bodies. In this way starch, sugar, and other similar organic compounds are produced.

In the case of plants living under water the supply of carbonic acid is derived from the surrounding water, where it is held in solution. It is also taken up in combination with lime as bicarbonate. Part of the carbonic acid is withdrawn, and the reduced mono-carbonate precipitated. Hence the incrustation of plants in both fresh and salt water.

Although nitrogen is present in the air to the extent of 79 per cent. by volume, none is absorbed by plants in the free condition.* It is derived almost entirely from the nitrates and ammoniacal compounds formed in the soil from decomposing organic substances.

Mineral salts can only pass through cell-membranes in a state of solution; hence soluble sulphates, phosphates, and chlorides of calcium, magnesium, potassium, and iron may pre-eminently be called food-salts. As the plants remove these from the soil it is necessary to replace them from time to time by means of manures of different kinds, and, as there is the power of selection, one plant preferring one substance, and another another, farmers find it expedient to vary their crops in rotation, so that the land may not become too much impoverished. Food-salts are absorbed by water-plants from the surrounding water through their whole surface, and their structure is simpler than is the case with land-plants.

In no class is absorption of mineral food-salts accomplished in so complicated a manner as in land-plants, and the process is by no means uniform in different plants. Every kind of earth, especially that rich in clay and humus, which is a substance produced by the decomposition of plants and animals, has the power of retaining gases, and especially water and salts.

Salts are to be regarded as forming an exceedingly delicate coating round the minute particles of earth, where they are forcibly retained. If a plant rooted in earth is to take in these salts, it has to overcome the force by which these molecules are detained. This is effected by the attraction exerted by the protoplasts of the plant as they grow, carry on the work of construction, and use up material. What actually happens is an energetic suction by the cells that are in close contact with particles of earth, depending upon the chemical affinity between substances in the interior of the cells and the salts adhering to earth-particles, as well as upon the consumption of food-salts for the manufacture of organic compounds within the green

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* Certain bacteria forming colonies on the roots of leguminous plants enable the latter to absorb free nitrogen.

cells. It is supposed that when salts are removed by suction a restitution of like salts immediately takes place from the surrounding mould, so that the concentration of the solution retained by the earth remains approximately the same, or at any rate equilibrium is very quickly restored. One advantage of this is that cells in immediate contact only meet with a saline solution of constant weak concentration, and are secure from injury which would result from contact with a very strong solution. In other words, the absorptive power of earth acts as a regulator of the process of absorption of food-salts by plants, and is the means of keeping the saline solution in the earth always at a degree of strength best suited to the plants concerned.

Naturally the passage of salts from the earth to the interior of the plant is dependent on the aid of water containing both the substances composing cell-contents and the food-salts in solution. The aqueous films adhering to the particles of earth, the water saturating the cell-membrane, and the liquid inside the cell are in unbroken connection, and along this continuous waterway the passage of salt-molecules in and out can take place easily. The majority of land-plants have special absorptive cells embedded amongst or lodged upon the earth-particles, and are usually in intimate connection with portions of them. Any part of the plant that penetrates into the earth, or lies upon it, may, if it performs the function of absorption, be equipped with cells of this kind, but they are most commonly found close behind the growing tips of roots; they consist of delicate tubes resembling fine hairs, and have received the name of root-hairs. These root-hairs, as in the case of most seedlings and in grasses, are generally thickly covered with particles of earth. In addition to absorption of nutritive salts by root-hairs, there is also in many cases an interchange of materials; that is to say, not only do substances infiltrate from the earth into the absorption-cells, and so onwards into the tissues of the plant, but others pass out of the plant through the absorption-cells into the earth. Amongst these substances carbonic acid in particular plays an important part, decomposing the earth-particles, and rendering food-salts in immediate proximity available.

Saprophytes are plants which take up organic compounds formed during the process of decay. Among these are moulds and other fungi, the mycelia, or vegetating portions, of which often cover large areas, as in damp cellars, tunnels, mines, &c. These plants contain no chlorophyll, and are in consequence unable to form those compounds known as carbohydrates.

Some plants, such as liverworts, ferns, and lycopods, although containing chlorophyll, must be regarded as saprophytes; so that the presence or absence of chlorophyll is by no means a distinguishing mark.

The probability is that green saprophytes take carbon from their substratum in a form unfitted for the manufacture of cellulose and other carbohydrates, whilst those that are not green must obtain carbon in the form of a compound, the direct absorption of which could be dispensed with if chlorophyll were present.

There is no well-marked boundary line between plants which absorb organic compounds and those which absorb inorganic compounds from their respective substrata; and there undoubtedly exist plants capable of taking up both kinds of material at the same time.

It is not a matter of indifference to these plants at what temperature and in what state of the air in respect of moisture the decomposition of humus takes place. Many plants live only a short time in a garden, even though the earth in which they are embedded be removed with them, owing probably to some difference in the organic compounds formed under the altered conditions. Saprophytes are much more fastidious as regards the quality of their nutriment than one might expect. A large number are associated with the decaying remains of particular plants and animals only.

A number of plants exhibit contrivances which obviously have for their object the capture and retention of such small creatures as may fly or creep on to their leaves, and it has been ascertained by searching experiments that the majority of these plants use the animals they capture, in one way or another, as sources of nutriment. For the most part the animals caught are insects, and the term insectivorous or carnivorous has been applied to the class in question. About 500 are known. The most extensive group is that of the bladderworts. Their capturing apparatus consists of little bladders with orifices closed by a valve, which permit objects to penetrate into the bladder, but not to issue out of it. They are rootless plants which live suspended in the water, and, according to the season of the year, either sink down to the bottom or ascend to just below the surface. The animals, mostly minute crustaceans, such as water-fleas, after entering the bladder, perish after a short time, decay, and the products of their decomposition are sucked up by special absorption-cells developed within the bladder.

In the pitcher-plants some of the leaves are converted into pit-falls, and the escape of the captured prey prevented by a number of points lining the inner wall of the cavity, and directed from the aperture towards the closed bottom. They are of various shapes—tubular, funnel-shaped, straight, bowed like sickles, or spirally twisted. Among these is the well-known side-saddle plant of America.

In another group of carnivorous plants are forms with scale-

like leaves, within which are cavities penetrable by minute animals only, on account of the narrowness of the entry. The animals are retained and drained of their juices by means of protoplasmic filaments radiating from special cells. One of these is the toothwort, a plant nearly allied to the yellow rattle, but is destitute of chlorophyll, and lives underground parasitic on the roots of trees and shrubs. The toothwort has not the power of converting atmospheric carbonic acid, or crude food-sap absorbed by its suckers from the plants to which it is attached, into the various organic compounds necessary for further growth. For this reason, and inasmuch as the quantity of nitrogenous compounds in the fluids withdrawn from the roots is but small, every additional supply of organic food, especially of nitrogenous matter such as is derived from captured animals, must be exceedingly welcome.

Some carnivorons plants perform movements for the capture of their prey. To this class belongs the butterwort. The flowers are borne singly on slender stalks arising from the centre of a rosette of leaves that rest upon the ground. The leaves are oblong, and, owing to the lateral margins being somewhat upturned, are converted into a broad flat-bottomed trough, which is covered with a colourless sticky mucilage secreted by glands distributed in large numbers over the entire upper surface. As soon as a nitrogenous organic body, such as white of egg, clotted blood, milk, &c., is brought into continuous contact with the glands, they are forthwith stimulated, not only to a more profuse elimination of mucilage, but also to the secretion of an acid liquid which has the power of dissolving all bodies of this kind. An insect alighting on the leaf is held fast by the mucilage, and the edges of the leaf curl over so as to cover it, and bring it into contact with as many glands as possible. This involution takes place very slowly, it being usually some hours before the insect is enfolded. After solution and absorption are accomplished, usually at the end of six hours, the leaf expands again, and its margins resume their original position. Spores and pollen-grains falling upon the leaf are subjected to the same fate as insects. The action of the acid liquid, which is a case of true digestion, is identical with that of the gastric juice of animals.

In the sundew the movements whereby the capture and digestion of small animals is effected occur much more rapidly and obviously. The leaves are covered with a number of club-shaped hairs, surmounted by a glistening drop of a sticky fluid, whose function is essentially the same as that of the glands of the butterwort. The insects that fly on to the leaves and are caught by the sticky liquid try to disencumber themselves by stroking the viscous matter off with their legs, only to besmear themselves

still more. They are soon plastered all over the body with the secretion, and after a brief interval die of suffocation. A few minutes after the glands of one of the tentacles has been excited by an animal becoming glued to it, a systematic disturbance is set up in the whole series of tentacles. First the tentacle originally irritated bends inwards, describing an angle of 90° in about ten minutes. About ten minutes after the first tentacle has been set in motion those standing near it begin to bend also, those further off follow suit, and in the course of from one to three hours all the tentacles are inflected and converge upon the body entrapped. The result of the combined action is the covering of the prey with a copious supply of the secretion poured from a number of glands, so that it is dissolved and rendered fit for absorption and for the purpose of nourishment. After absorption is completed the tentacles resume by degrees their original position, and the secretion poured out by them is reimbibed; so that the undigested particles, being now suspended on dry tentacles, are easily blown away by the wind. In the case of the Venus's fly-trap the movements are still more rapid. In this case the leaves, which are divided by the midrib into two halves, shut up almost instantaneously upon an insect touching any of the spines on their surface. An acid secretion is then poured forth from glands on the surface, and the insect is assimilated.

Another group of plants is that of the parasites, which mostly do not contain chlorophyll, and are therefore unable to decompose carbonic acid, and hence derive all their organic compounds from other living plants and animals. The lowest forms of this group are the Bacteria, a group of fungi, specific forms of which are found in the blood in many diseases. The spores of some other fungi enter the breathing-pores of insects, and, after vegetating for a time, kill the animal by suffocation. The silk-worm disease is due to this cause.

Among flowering plants we have the common dodder, which may be found growing on heather and other plants. The seed first of all germinates in the earth in the ordinary way, and becomes afterwards attached by suckers to other plants, from which it obtains all its nutriment, the original root perishing. Others, such as the cow-wheat, yellow rattle, eyebright, and lousewort, are parasitic on roots.

But the most wonderful plant is the gigantic *Rafflesia*, conspicuous for its flowers upwards of a yard in diameter. This plant is found growing upon the roots of species of vine in Sumatra and other East Indian islands.

Among parasites containing chlorophyll is the mistletoe. The outer coating of the fruit is very viscid, by means of which the seed becomes attached to trees, and is also disseminated by the

agency of thrushes, who swallow the fruit and deposit the undigested seed on branches.

There is a form of parasitism which has been called symbiosis, a kind of partnership from which both plants derive an advantage. The lichens are an example of this. They were formerly considered to be a distinct class, but have now been shown to be fungi enclosing algæ. The roots of some trees and flowering plants are found to be covered with the mycelia of fungi. These act as an absorptive apparatus, and water and mineral salts are caused to pass from the ground into the epidermal cells of the root, and thence into the axis, branches, and leaves.

I am indebted for a great deal of this paper to the 'Natural History of Plants' of Prof. Kerner, of Vienna. It is a book which will well repay a careful study, and will convince the reader that botany can no longer be regarded as "a dry subject."

120.—Report of the Meteorological Sub-Committee for 1894.

Prepared by the Hon. Sec., Francis Campbell-Bayard, F.R. Met. Soc.

(Read February 19th, 1895.)

The arrangements for observing the daily rainfall round Croydon have been successfully carried out on the same plan as heretofore, but on a greatly enlarged scale, and with, it is hoped, greater efficiency. The number of stations contained in the monthly sheet has been increased by 14, filling up several gaps in the list of places, and consequently making the printed returns more and more representative. Two stations have disappeared through the removal of the observers, namely, the College, Caterham Valley, and Foxgrove, Beckenham, the record of which latter station commences with the year 1868. Through the courtesy of Mr. Bicknell, the observer at Foxgrove, Beckenham, a complete copy of this valuable record has been supplied to the Hon. Sec. The places of these stations have been taken by Abinger, which appears to have a peculiarly heavy rainfall, and West Molesey, both of which stations are very welcome.

The monthly sheets contain all the records which are received by the Sub-Committee, and the stations of which the records have been tabulated number 66 as against 63 in the last report, and the observers number 54 as against 53 in the last report.

Appendix I. to this report contains the tables of daily rainfall issued monthly, and of which a sufficient number have from time to time been pulled for the use of the Club; and Appendix II.

contains a record of all falls of rain of 1·00 in. and upwards, extracted from Appendix I.

With respect to the rainfall of the year, a great many persons in this district would have said that 1894 was a very wet year. Our hon. member Mr. Symons has, however, shown, in a letter published in the 'Times' of January 19th, that the rainfall of 1894 may be considered as quite an ordinary rainfall. However this may be over the whole of the United Kingdom, the records in the possession of your Sub-Committee show that, at all events in our district, the year has been a very wet one. To prove this, tables A, B, C, D, and E have been constructed.

Tables A, B, and C refer to Greenwich. Table A shows that the rainfall is 1·77 in. above the 75 years' average (1816–90), 2·34 in. above the 50 years' average (1841–90), and 2·46 in. above the 35 years' average (1856–90). These tables show in a marked way how fallacious a short average may be; and as far as one can judge it would appear that even a 75 years' average may be too small.

Tables C, D, and E give the difference from the 35 years' average at Greenwich, Surbiton, and Mt. Ararat, Wimbledon, the only three stations in the printed sheet having this long average. This shows in respect to 1894 an excess of 2·46 in. at Greenwich, 3·08 in. at Surbiton, and 5·61 in. at Mt. Ararat, Wimbledon. This last amount appears somewhat large, but it is probably correct, for we, who live in the district, all know that a great many storms travel along the Wimbledon range of hills.

With regard to the question as to what is the excess of the rainfall over the district on an average of a long series of years, it appears to be between 2 and 3 in., not a large amount when the deficiency of 1893 was estimated at 5 in.

The district, so far as your Sub-Committee is aware, has not been injuriously affected by the floods, of which we heard so much from the daily papers as having taken place in different parts of the Catchment Area of the River Thames.

The Sub-Committee would draw the attention of the members of the Club to the comparatively large number of days—eight in number—on which 1 in. or more fell in twenty-four hours, and in so doing would call attention to the very large fall of 2·42 in. on October 30th at Chatfield Road, Croydon. The Sub-Committee have no reason to doubt the observer's accuracy, though the amount appears large in comparison with other stations near by.

In conclusion the Sub-Committee desire to express their thanks to those four gentlemen who so kindly subscribed the sum of £20 to enable this great work to be carried on, and to all the observers for their hearty co-operation in so promptly forwarding their returns.

A.—*Greenwich Average* 75 *Yrs.* (1816–90).

	Average	1894	± Average
	IN.	IN.	IN.
Jan.	1·90	3·08	+ 1·18
Feb.	1·61	1·59	— 0·02
March	1·54	0·72	— 0·82
April	1·70	1·45	— 0·25
May	2·04	1·52	— 0·52
June	2·00	2·04	+ 0·04
July	2·58	3·26	+ 0·68
Aug.	2·31	3·03	+ 0·72
Sept.	2·38	1·25	— 1·13
Oct.	2·75	3·99	+ 1·24
Nov.	2·37	3·00	+ 0·63
Dec.	1·93	1·95	+ 0·02
Year	25·11	26·88	+ 1·77

B.—*Greenwich Average* 50 *Yrs.* (1841–90).

	Average	1894	± Average
	IN.	IN.	IN.
Jan.	1·99	3·08	+ 1·09
Feb.	1·48	1·59	+ 0·11
March	1·46	0·72	— 0·74
April	1·66	1·45	— 0·21
May	2·01	1·52	— 0·49
June	2·02	2·04	+ 0·02
July	2·48	3·26	+ 0·78
Aug.	2·34	3·03	+ 0·69
Sept.	2·25	1·25	— 1·00
Oct.	2·81	3·99	+ 1·18
Nov.	2·27	3·00	+ 0·73
Dec.	1·77	1·95	+ 0·18
Year	24·54	26·88	+ 2·34

C.—*Greenwich Average* 35 *Yrs.* (1856–90).

	Average	1894	± Average
	IN.	IN.	IN.
Jan.	2·02	3·08	+ 1·06
Feb.	1·46	1·59	+ 0·13
March	1·48	0·72	— 0·76
April	1·70	1·45	— 0·25
May	2·03	1·52	— 0·51
June	2·15	2·04	— 0·11
July	2·34	3·26	+ 0·92
Aug.	2·25	3·03	+ 0·78
Sept.	2·31	1·25	— 1·06
Oct.	2·60	3·99	+ 1·39
Nov.	2·16	3·00	+ 0·84
Dec.	1·92	1·95	+ 0·03
Year	24·42	26·88	+ 2·46

D.—*Surbiton Average* 35 *Yrs.* (1856–90).

	Average	1894	± Average
	IN.	IN.	IN.
Jan.	2·11	3·14	+ 1·03
Feb.	1·54	1·39	— 0·15
March	1·48	0·96	— 0·52
April	1·72	1·83	+ 0·11
May	1·98	1·49	— 0·49
June	2·17	2·00	— 0·17
July	2·28	3·51	+ 1·23
Aug.	2·35	2·66	+ 0·31
Sept.	2·35	1·25	— 1·10
Oct.	2·65	4·81	+ 2·16
Nov.	2·10	2·83	+ 0·73
Dec.	1·86	1·80	— 0·06
Year	24·59	27·67	+ 3·08

E.—*Mt. Ararat, Wimbledon, Average* 35 *Yrs.* (1856–90).

	Average	1894	± Average
	IN.	IN.	IN.
Jan.	1·80	3·03	+ 1·23
Feb.	1·39	1·89	+ 0·50
March	1·38	0·90	— 0·48
April	1·74	1·45	— 0·29
May	1·99	1·57	— 0·42
June	2·14	2·57	+ 0·43
July	2·38	4·22	+ 1·84
Aug.	2·21	2·93	+ 0·72
Sept.	2·41	1·42	— 0·99
Oct.	2·68	4·44	+ 1·76
Nov.	2·09	3·18	+ 1·09
Dec.	1·72	1·94	+ 0·22
Year	23·93	29·54	+ 5·61

CROYDON MICROSCOPICAL AND NATURAL HISTORY CLUB *(Meteorological Subcommittee).*

Stations.	Observers.	Size of Gauge.	Height above Ground.		Height of Statn. ab. Sea-level.
		IN.	FT.	IN.	FT.
Surrey—					
Dorking (Denbies)	J. Beesley	5	0	6	610
Reigate Hill (Margery Hall)	W. F. Taylor	5	2	0	756
Upper Gatton	F. Druce	5	1	0	600
Caterham (Metropol. Asylum)	G. S. Elliott, M.D.	5	1	0	610
Caterham Valley (Congreg. Shl.)	Miss S. W. Rudd	5	1	0	500
Marden Park (Birchwood House)	Mrs. F. Rutley	5	1	0	471
Kent—					
Westerham (The Fishponds)	W. Morris	5	1	0	380
Knockholt (The Beeches)	W. Morris	5	1	0	785
Surrey—					
Warlingham (The Vicarage)	Rev. F. R. Marriott	5	1	0	614
Coulsdon (The Grange)	W. J. Stride	5	1	4	525
Kenley (Ingleside)	H. Smith	8	1	0	375
Purley (Tudor Cottages)	J. Bonwick	5	1	0	216
Ashtead (D'Abernon Chase)	Rev. Sir W. Vincent, Brt.	5	1	0	280
Oxshott	W. H. Dines	5	1	0	212
Epsom (Epsom College)	C. J. Gardiner	8	1	0	290
Banstead (The Larches)	Rev. C. J. Taylor	8	1	0	488
Sutton (Mulgrave Road)	W. Goode	5	5	6	230
Wallington (Manor Road)	F. C. Bayard	5	4	1	157
Beddington (Riverside)	S. Rostron	5	1	0	120
Waddon (Waddon House)	P. Crowley	5	1	0	156
Croydon (Brimstone Barn)	Croydon Corporation	5	1	0	130
Croydon (Waddon New Road)	Croydon Corpcration	5	1	0	146
Croydon (Duppas House)	Baldwin Latham	8	1	0	158
Croydon (Chatfield Road)	A. Malden	5	1	0	166
Croydon (Whitgift School)	A. E. Watson	5	1	0	191
Croydon (Park Hill Rise)	H. F. Parsons, M.D.	5	1	0	250
Croydon (Outram Road)	E. Mawley	8	0	9	202
Addington Hills (The Reservoir)	Croydon Corporation	8	0	9	473
Addington (Park Farm)	W. Whalley	5	1	0	268
Addington (Pumping Station)	Croydon Corporation	8	1	0	331
Kent—					
West Wickham (Wickham Ct.)	Sir J. F. Lennard, Bart.	5	1	2	300
West Wickham (Layham's Fm.)	W. Ashcroft	5	1	0	500
Hayes Common (The Warren)	Miss Akers	5	1	0	296

Stations.	Observers.	Size of Gauge.	Height above Ground.		Height of Statn. ab. Sea-level.
		IN.	FT.	IN.	FT.
Kent—					
Keston (Bradfield)	A. Hill	5	1	0	350
Keston (Tower Fields)	G. Buchanan	8	0	9	351
Orpington (Kent Water Co.)	W. Morris	5	1	0	220
Farningham Hill	A. J. Waring	5	3	0	300
Wilmington (Kent Water Co.)	W. Morris	5	1	0	25
Bickley (Highfield)	J. Batten	5	1	2	295
Bromley (Sundridge Avenue)	J. B. Snell	5	1	0	245
Bromley Common (Elmfield)	Rev. J. P. Faunthorpe	5	0	9	240
Beckenham (Foxgrove)	P. Bicknell	5	0	6	142
Beckenham (Cedars Road)	H. Dolling Smith	5	1	0	105
Surrey—					
South Norwood (Selhurst Road)	J. Potter	5	1	0	200
Thornton Heath (Thornton Rd.)	A. Wright	8	0	10	120
Wimbledon (Sewage Works)	C. H. Cooper	5	1	0	58
Wimbledon (Mount Ararat)	T. Devas	12	3	0	157
Raynes Park (Pumping Station)	C. H. Cooper	5	1	0	47
New Malden (Sewage Works)	T. V. H. Davison	5	1	0	45
Esher (Sewage Works)	W. H. Hope	5	1	0	40
Surbiton (Seething Wells)	R. Hack	10	0	6	25
Kingston (Sewage Works)	T. Stevens	5	1	0	25
Richmond (Ormond Lodge)	J. T. Billett	5	0	9	51
Wandsworth Com. (Patten Rd.)	F. J. Brodie	5	1	0	100
Streatham Hill (Wavertree Rd.)	F. Jordan	5	0	10	178
West Norwood (Thornlaw Road)	W. Marriott	8	1	0	220
Kent—					
Forest Hill (Dartmouth Road)	Mrs. Behrens	5	1	0	220
Forest Hill (The Nurseries)	James Carter & Co.	6	0	6	76
Forest Hill (S. & V. Water Co.)	J. W. Restler	5	1	0	344
Eltham (High Street)	W. Morris	5	1	0	245
Woolwich (Powis Street)	J. G. Waller	5	30	0	65
Greenwich (Royal Observatory)	Astronomer Royal	8	0	5	155
Deptford (Kent Water Co.)	W. Morris	5	1	0	20
Nunhead (S. & V. Water Co.)	J. W. Restler	5	4	0	176
Surrey—					
Brixton (Acre Lane)	F. Gaster	8	1	0	77
Battersea (S. & V. Water Co.)	J. W. Restler	5	3	0	21

Daily Rainfall. *The 50 years (1841–90) mean at Greenwich for January is 1·99 in.* **January, 1894.**

Day of Mo.	Dorking	Reigate Hill	Upper Gatton	Caterham	Caterham Valley	Marden Park	Westerham	Knockholt	Warling-ham	Coulsdon	Kenley	Purley (Tudor C.)
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	..	..	..	..	·01	..		..	..	..	..
2	·12	·03	·14	·12	·17	·10	·05		·05	·03	·05	·06
3	·12	·02	·23	·20	·34	·23	·16		·16	·09	·16	·22
4	·08	·12	..	..	..	..	·01		·01	..	·01	·02
5	·10	·10	·14	·13	·18	·14	·13		·14	·08	·14	·19
6	..	..	·01	..	..	..	..		..	..	..	..
7	..	..	..	..	..	..	..		..	..	..	..
8	·08	..	·05	·05	·12	·09	·04		·04	·02	·04	·05
9	·15	·12	·17	·23	·13	·05	·14		·15	·16	·15	·21
10	·05	·07	·06	·05	·06	·03	..		..	..	·03	·03
11	·18	..	·17	·19	·17	·18	·19		·20	·20	·29	·15
12	·03	..	·02	·02	·03	·01	·03		..	·03	·02	..
13	·39	·41	·37	·39	·20	·37	·30	MONTHLY GAUGE.	·45	·34	·21	·32
14	·15	·20	·23	·20	·28	·11	·13		·09	·17	·28	·17
15	·23	·19	·22	·21	·21	..	·15		·20	·22	·23	·16
16	·10	·13	·17	·20	·13	·23	·09		·16	·11	·09	·05
17	·15	·17	·18	·18	·21	·14	·23		·19	·18	·18	·12
18	..	..	·01	..	..	·01	..		..	..	..	..
19	·30	·27	·32	·28	·21	·21	·20		·24	·24	·32	·17
20	·06	·04	·06	·06	·09	·05	·04		·06	·04	·05	..
21	·03	·06	·06	·15	..	..	·12		·29	·03	·01	·03
22	·50	·52	·53	·57	·45	·31	·40		·38	·47	·47	·41
23	..	..	..	..	..	..	..		..	..	..	..
24	·14	·07	·19	·23	·12	·12	·10		..	·09	·11	·06
25	·55	·60	·69	·68	·41	·40	·67		·80	·48	·54	·37
26	·02	..	·02	..	..	·01	·02		·03	..	·01	·02
27	·10	·08	·13	·18	·09	·10	·23		·17	·09	·15	·16
28	·02	..	..	..	..	..	..		..	..	..	..
29	·18	·15	·15	·18	·09	·10	·17		·14	·10	·15	·06
30	·32	·35	·41	·47	·43	·39	·16		·38	·26	·33	·27
31	·13	·17	·20	·11	·11	·20	·27		·18	·27	·11	·16
*	4·28	3·87	4·93	5·08	4·23	3·59	4·03	2·25	4·51	3·70	4·13	3·46
†	4·28	3·87	4·93	5·08	4·23	3·59	4·03	2·25	4·51	3·70	4·13	3·46

Day of Mo.	Ashtead	Oxshott	Epsom	Banstead	Sutton	Wallington	Bedding-ton	Waddon	Croydon (Brim. Bn.)	Croydon (Wn.N.rd.)	Croydon Duppas H.	Croydon Chatfd. rd.	Croydon (Whitgift)	Croydon (Park Hill)
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·02	..	..	..	·02	..	..	·01	..	..	·01	..	..	·02
2	·02	·05	·12	..	..	·06	·07	..	·08	·05	·07	..	·06	·07
3	·26	·12	·19	·20	·50	·17	·17	·08	·20	·14	·20	·25	·25	·16
4	·01	·01	·02	..	..	·01	·01	·02	..	·01	·01	..	·03	..
5	·06	·08	·15	·14	·15	·11	·06	·11	·14	·10	·12	·13	·20	·13
6	..	..	..	..	..	..	..	..	..	..	..	..	..	..
7	..	..	..	..	..	..	..	..	..	..	..	..	..	..
8	·03	·03	·06	·06	·07	·04	·03	·02	..	·07	·04	·03	·03	·02
9	·05	·06	..	·12	·06	·06	·07	·05	·06	·01	·06	·05	·05	·05
10	·01	·01	..	·02	..	·01	·01	·01	·02	·01	·01	·01	..	..
11	·10	·12	·16	·18	·14	·13	·12	·11	·11	·10	·11	·09	·12	·11
12	·01	·01	·20	·02	..	·01	·01	·01	·02	..	·01	·01	·01	·01
13	·25	·27	·27	·22	·28	·20	·20	·28	·19	·34	·23	·24	·20	·25
14	·36	·35	·25	·27	·19	·30	·31	·22	·32	·14	·28	·27	·19	·25
15	·12	·10	·14	·21	·13	·14	·13	·11	·12	·12	·13	·10	·13	·13
16	·14	·03	·20	·04	..	·02	·02	·02	·02	·02	·02	·01	·02	·03
17	·12	·12	·17	·18	·10	·10	·10	·09	·11	·09	·10	·13	·11	·10
18	..	..	..	..	..	..	..	..	..	..	·01	..	..	..
19	·12	·12	·16	·22	·13	·17	·16	·13	·15	·14	·14	·11	·16	·17
20	·09	·07	·04	·03	·07	·07	·07	·05	·09	·05	·06	..	·06	·05
21	·01	..	·02	·01	·01	·01	..	..	..	·01	·01	..	..	·01
22	·36	·37	·43	·47	·41	·46	·37	·34	·35	·34	·35	·37	35	·36
23	..	..	..	..	..	·02	..	..	..	..	..	..	..	..
24	·06	·06	·07	·08	·07	·07	·06	·05	·06	·05	·06	·05	·05	·05
25	·25	·26	·31	·38	·29	·32	·31	·28	·28	·28	·30	·25	·30	·31
26	·01	..	..	·01	..	·01	..	..	..	..	·01	..	..	..
27	·08	·09	·17	·11	·12	·13	·15	·13	·14	·14	·13	·09	·12	·14
28	..	..	..	..	..	..	..	..	..	..	..	..	..	..
29	·08	·08	·07	·08	·08	·07	·07	·06	·07	·05	·06	·06	·06	·07
30	·16	·20	·15	·21	·26	·17	·17	·19	·14	·16	·18	·16	·18	·21
31	·14	·10	·17	·17	·10	·17	·16	·15	·17	·13	·16	·16	·19	·13
*	2·92	2·71	3·52	3·43	3·18	3·03	2·83	2·52	2·84	2·55	2·87	2·57	2·87	2·83
†	2·92	2·71	3·52	3·43	3·18	3·03	2·83	2·52	2·84	2·55	2·87	2·57	2·87	2·83

* The figures in this row give the totals for the month. † The totals from January 1st.

Day of Mo.	Croydon (Outm. Rd.)	Addington Hills	Addington (Park Fm.)	Addington (Pump. St.)	W. Wickhm Wickhm. C.	W. Wickhm Layhms. F.	Hayes Common	Keston (Bradfield)	Keston (Tow. Fds.)	Orpington	Farningham Hill	Wilmington	Bickley
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	..	..	..	..	..	..	·03	..	..	·01	·01	..
2	·03	·02	·06	·04	..	·13	·05	·05	·14	·04	·09	..	·06
3	·22	·04	·10	..	·16	·07	·03	·11	·15	·03	·25	·04	·18
4	·01	·01	·03	·05	..	..	·01	·01	·01	·01	..	·02	·02
5	·13	·15	·14	·08	·20	·16	·12	·06	·13	·10	·11	·11	·11
6	..	..	..	..	..	..	..	..	..	..	..	..	..
7	..	..	..	..	..	..	..	..	..	..	..	..	..
8	·03	·04	·01	·03	·02	..	·03	·03	..	·03	·06	..	..
9	·03	·06	·08	·06	·05	·10	·04	·06	·08	·06	·04	·06	·06
10	·01	..	·03	·02	..	·01	·01	·01	·01	·01	·02	..	·02
11	·10	·13	·13	·14	·12	·14	·10	·10	·12	·10	..	·05	·07
12	·01	·01	·01	·01	·01	·02	·01	·01	·02	·01	·08	..	·01
13	·24	·21	·09	·24	·20	·17	·17	·22	·11	·19	·19	·11	·13
14	·22	·23	·30	·15	·21	·25	·21	·18	·29	·17	·13	·20	·25
15	·14	·15	·20	·18	·15	·17	·15	·15	·19	·16	·14	·07	·10
16	·03	·03	·05	·08	·05	·09	·04	·04	..	·06	·04	·02	·01
17	·10	·13	·11	·10	·11	·19	·08	·08	·17	·11	·09	·04	·07
18	..	..	·01	..	..	..	·01	..	..	..	..	..	..
19	·19	·24	·27	·27	·24	·24	·22	·13	·23	·16	·11	·10	·15
20	·05	·03	·03	·04	·02	·06	·02	·04	·06	..	·03	·01	·02
21	·01	·01	..	·02	·01	..	·01	·01	·01	·07	·05	·02	..
22	·36	·38	·40	·43	·43	·56	·38	·34	·44	·45	·41	·33	·40
23	..	..	..	..	..	..	..	..	..	..	..	..	..
24	·06	·07	·09	·08	·05	·07	·05	·04	·05	·04	·02	·02	·03
25	·32	·38	·48	·49	·47	·57	·40	·38	·53	·44	·46	·26	·32
26	·01	·01	·01	·01	..	·01	·01	·01	·01	..	·01	..	..
27	·12	·12	·15	·20	·10	·18	·09	·10	·12	·07	·12	·08	·09
28	..	..	..	..	..	·01	..	..	..	..	..	..	..
29	·07	·08	·11	·11	·07	·14	·08	·05	·09	·12	·06	·08	·06
30	·20	·19	·17	·24	·25	·26	·20	·16	·23	·46	·16	·18	·18
31	·13	·18	·25	·23	·20	·27	·20	·25	·20	·06	·32	·20	·20
*	2·82	2·90	3·31	3·30	3·12	3·87	2·77	2·65	3·39	2·95	3·00	2·01	2·54
†	2·82	2·90	3·31	3·30	3·12	3·87	2·77	2·65	3·39	2·95	3·00	2·01	2·54

Day of Mo.	Bromley	Bromley Common	Beckenham (Foxgrove)	Beckenham (Cedars rd.)	South Norwood	Thornton Heath	Wimbledon (Sew. Wks.)	Wimbledon (Mt. Ararat)	Raynes Park	New Malden	Esher	Surbiton	Kingston
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	..	·01	·01	..	..	·01	..	·02	..	..	..	..
2	·03	·08	·02	·05	·05	..	·06	·05	·06	·02	·02	·04	·03
3	·06	·10	·08	·24	·26	·35	·24	·20	·31	·03	·10	·25	·08
4	·01	..	·02	·02	·02	..	·05	·04	·04	..	·01	·25	·01
5	·10	·13	·13	·16	·13	·20	·14	·12	·13	·09	·06	·07	·09
6	..	..	..	..	..	..	·01	·01	·02	..	..	..	..
7	..	..	..	..	·01	..	..	..	..	..	..	..	..
8	·01	..	·02	·02	·03	..	..	..	·02	·01	·04	..	·08
9	·06	·08	·06	·06	·01	·07	·34	·21	·25	·23	·21	·24	·31
10	·01	·01	..	..	..	..	·01	..	·03	..	·02	..	·01
11	·07	·08	·10	·09	·08	·10	·09	·11	·13	·12	·12	·14	·13
12	·01	·01	·01	·01	..	·02	·01	..	·03	..	·03	..	·01
13	·15	·16	·25	·18	·20	·25	·26	·35	·22	·30	·29	·32	·46
14	·22	·21	·18	·26	·29	·25	·29	·21	·36	·25	·27	·28	·18
15	·11	·13	·11	·11	·11	·13	·15	·17	·16	·15	·16	·15	·20
16	·02	·04	·02	·02	·02	..	..	·01	·03	..	·02	·01	·02
17	·09	·08	·12	·11	·08	·10	·16	·20	·19	·14	·21	·15	·19
18	·01	..	..	..	..	..	..	..	·02	..	·01	..	..
19	·15	·17	·10	·12	·12	·07	·08	·10	·13	·07	·08	·09	·11
20	·04	·03	·05	·05	·08	·10	·04	·04	·07	·04	·05	·04	·04
21	·01	·02	..	..	..	·08	..	..	·02	..	..	..	..
22	·37	·33	·43	·37	·32	·25	·30	·35	·36	·31	·34	·34	·40
23	..	..	..	..	..	..	..	..	..	..	·02	..	..
24	·04	·04	·04	·05	·04	·07	·05	·08	·08	·04	·04	·04	·05
25	·33	·33	·26	·26	·25	·23	·17	·21	·20	·16	·25	·20	·29
26	·02	·01	·01	·01	..	..	·01	..	..	..	·02	..	..
27	·10	·12	·12	·09	·11	·10	·10	·13	·17	·12	·10	·14	·11
28	·01	..	..	..	..	..	..	..	..	..	..	..	..
29	·07	·06	·06	·08	·07	·08	·12	·09	·11	·08	·11	·09	·16
30	·17	·15	·21	·20	·15	·23	·20	·20	·22	·17	·22	·20	·32
31	·25	·21	·18	·16	·18	·13	·19	·15	·17	·12	·07	·10	·07
*	2·52	2·58	2·59	2·73	2·61	2·81	3·08	3·03	3·55	2·45	2·87	3·14	3·35
†	2·52	2·58	2·59	2·73	2·61	2·81	3·08	3·03	3·55	2·45	2·87	3·14	3·35

* The figures in this row give the totals for the month. † The totals from January 1st.

Daily Rainfall. *50 years (1841-90) mean for Greenwich for Jan. is 1·99 in.* **January, 1894.**

Day of Mo.	Richmond	Wandswth. Common	Streatham Hill	West Norwood	Forest Hill Dartmh.rd.	Forest Hill (Nurseries)	Forest Hill S.&V.W.C.	Eltham	Woolwich	Greenwich	Deptford	Nunhead	Brixton	Battersea
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·03	..	..	..	..	·03	..	..	..	·01	..	..	..	..
2	·03	·04	·07	·04	..	·02	·02	..	·05	·07	·04	..	·05	..
3	·06	·17	·27	·19	·09	·03	·02	·03	·13	·24	·21	·03	·20	·03
4	·03	·05	07	·03	..	..	..	..	·20	·09	·07	..	·05	..
5	·09	·14	·14	·12	·27	·15	·11	·05	·12	·14	·12	·04	·14	·04
6	..	..	..	..	..	..	..	..	..	..	·02	..	·02	..
7	..	..	..	..	..	..	..	..	..	..	..	..	..	..
8	·12	..	·02	·01	·01	..	..	·03	·10	·03	..	·03	..	·03
9	·33	·43	·32	·13	·14	·12	·15	·15	·31	·27	·25	·23	·45	·32
10	·03	·02	·01	·01	..	..	·01	..	..	·01	..	..	·02	..
11	·12	·13	·10	·09	·10	·11	·15	·10	·09	·11	·11	·11	·12	·12
12	·02	·01	·01	..	..	·01	..	..	..	·01	..	..	..	..
13	·29	·37	·19	·21	·28	·13	·14	·08	·03	·29	·11	·17	·04	·35
14	·24	·14	·31	·26	·19	·34	·34	·37	·39	·23	·36	·32	·45	·11
15	·16	·15	·09	·13	·10	·11	·11	·09	·11	·14	·14	·12	·14	·14
16	·03	·02	·01	·01	·01	·02	·01	·01	·01	·01	·01	..	·01	·02
17	·14	·14	·13	·18	·18	·16	·17	·11	·16	·10	·09	·09	·15	·10
18	..	..	·01	..	..	..	·01	..	..	..	..	..	..	..
19	·11	·09	·07	·09	·09	..	·09	·08	·07	·07	·07	·05	·08	·06
20	·07	·04	·03	·04	·04	·18	·04	·07	·03	·02	·03	..	·04	·04
21	·01	·01	·01	..	..	..	..	..	..	..	..	..	..	..
22	·34	·32	·31	·37	·41	·47	·43	·42	·41	·41	·41	·37	·32	·33
23	..	..	..	..	..	..	..	..	..	..	..	..	..	..
24	·05	·05	·05	·06	·06	·08	·06	·07	·04	·04	·04	·03	·05	·03
25	·30	·18	·15	·21	·23	·28	·22	·23	·18	·18	·17	·11	·18	·19
26	·01	·01	·01	·01	..	..	..	..	..	..	..	..	·01	..
27	·11	·11	·16	·16	·15	·15	·22	·15	·07	·08	·09	·08	·10	·09
28	..	·01	·01	..	..	..	..	..	..	..	..	..	..	..
29	·22	·15	·12	·09	·10	·09	·10	·06	·16	·18	·20	·14	·21	·15
30	·19	·17	·18	·18	·16	·19	·17	·20	·28	·17	·16	·15	·15	·15
31	·10	·14	·13	·15	·17	·22	·16	·23	·08	·18	·18	·16	·19	·16
*	3·23	3·09	2·98	2·77	2·78	2·89	2·73	2·53	3·02	3·08	2·88	2·23	3·17	2·46
†	3·23	3·09	2·98	2·77	2·78	2·89	2·73	2·53	3·02	3·08	2·88	2·23	3·17	2·46

* The figures in this row give the totals for the month. † The totals from January 1st.

Note.—The observations are taken at 9 a.m., except at Brixton and Addington Park Farm (8 a.m.), Bromley (8.30 a.m.), South Norwood (8.45 a.m.), and Croydon (Waddon New Road) (10 a.m.).

NOTES.

(January, 1894.)

The month has been very wet, warm, and unhealthy, scarlet fever and influenza being very prevalent. The first seven days were very cold, the 5th and 7th being especially so. The rainfall is at Greenwich the heaviest since 1886. Tulips and daffodils were showing above ground at Warlingham on the 15th, and on the 21st snowdrops were in bloom there. The mean temperature is about the average, being at Wallington 37·6°, and at Waddon 37·2°. Sunlight at Wallington was 24 per cent. of the possible duration, being an excess of 5 per cent. over the average.

Francis Campbell Bayard, F.R.Met.Soc.,
Hon. Sec.

CROYDON MICROSCOPICAL AND NATURAL HISTORY CLUB *(Meteorological Subcommittee).*

Stations.	Observers.	Size of Gauge.	Height above Ground.		Height of Statn. ab. Sea-level.
		IN.	FT.	IN.	FT.
SURREY—					
Dorking (Denbies)	J. Beesley	5	0	6	610
Reigate Hill (Margery Hall)	W. F. Taylor	5	2	0	756
Upper Gatton	F. Druce	5	1	0	600
Caterham (Metropol. Asylum)	G. S. Elliott, M.D.	5	1	0	610
Caterham Valley (Congreg. Shl.)	Miss S. W. Rudd	5	1	0	500
Marden Park (Birchwood House)	Mrs. F. Rutley	5	1	0	471
KENT—					
Westerham (The Fishponds)	W. Morris	5	1	0	380
Knockholt (The Beeches)	W. Morris	5	1	0	785
SURREY—					
Warlingham (The Vicarage)	Rev. F. R. Marriott	5	1	0	614
Coulsdon (The Grange)	W. J. Stride	5	1	4	525
Kenley (Ingleside)	H. Smith	8	1	0	375
Purley (Tudor Cottages)	J. Bonwick	5	1	0	216
Ashtead (D'Abernon Chase)	Rev. Sir W. Vincent, Brt.	5	1	0	280
Oxshott	W. H. Dines	5	1	0	212
Epsom (Epsom College)	C. J. Gardiner	8	1	0	290
Banstead (The Larches)	Rev. C. J. Taylor	8	1	0	488
Sutton (Mulgrave Road)	W. Goode	5	5	6	230
Wallington (Manor Road)	F. C. Bayard	5	4	1	157
Beddington (Riverside)	S. Rostron	5	1	0	120
Waddon (Waddon House)	P. Crowley	5	1	0	156
Croydon (Brimstone Barn)	Croydon Corporation	5	1	0	130
Croydon (Waddon New Road)	Croydon Corporation	5	1	0	146
Croydon (Duppas House)	Baldwin Latham	8	1	0	158
Croydon (Chatfield Road)	A. Malden	5	1	0	166
Croydon (Whitgift School)	A. E. Watson	5	1	0	191
Croydon (Park Hill Rise)	H. F. Parsons, M.D.	5	1	0	250
Croydon (Outram Road)	E. Mawley	8	0	9	202
Addington Hills (The Reservoir)	Croydon Corporation	8	0	9	473
Addington (Park Farm)	W. Whalley	5	1	0	268
Addington (Pumping Station)	Croydon Corporation	8	1	0	331
KENT—					
West Wickham (Wickham Ct.)	Sir J. F. Lennard, Bart.	5	1	2	300
West Wickham (Layham's Fm.)	W. Ashcroft	5	1	0	500
Hayes Common (The Warren)	Miss Akers	5	1	0	296

Stations.	Observers.	Size of Gauge.	Height above Ground.		Height of Statn. ab. Sea-level.
		IN.	FT.	IN.	FT.
KENT—					
Keston (Bradfield)	A. Hill	5	1	0	350
Keston (Tower Fields)	G. Buchanan	8	0	9	351
Orpington (Kent Water Co.)	W. Morris	5	1	0	220
Farningham Hill	A. J. Waring	5	3	0	300
Wilmington (Kent Water Co.)	W. Morris	5	1	0	25
Bickley (Highfield)	J. Batten	5	1	2	295
Bromley (Sundridge Avenue)	J. B. Snell	5	1	0	245
Bromley Common (Elmfield)	Rev. J. P. Faunthorpe	5	0	9	240
Beckenham (Foxgrove)	P. Bicknell	5	0	6	142
Beckenham (Cedars Road)	H. Dolling Smith	5	1	0	105
SURREY—					
South Norwood (Selhurst Road)	J. Potter	5	1	0	200
Thornton Heath (Thornton Rd.)	A. Wright	8	0	10	120
Wimbledon (Sewage Works)	C. H. Cooper	5	1	0	58
Wimbledon (Mount Ararat)	T. Devas	12	3	0	157
Raynes Park (Pumping Station)	C. H. Cooper	5	1	0	47
New Malden (Sewage Works)	T. V. H. Davison	5	1	0	45
Esher (Sewage Works)	W. H. Hope	5	1	0	40
Surbiton (Seething Wells)	R. Hack	10	0	6	25
Kingston (Sewage Works)	T. Stevens	5	1	0	25
Richmond (Ormond Lodge)	J. T. Billett	5	0	9	51
Wandsworth Com. (Patten Rd.)	F. J. Brodie	5	1	0	100
Streatham Hill (Wavertree Rd.)	F. Jordan	5	0	10	178
West Norwood (Thornlaw Road)	W. Marriott	8	1	0	220
KENT—					
Forest Hill (Dartmouth Road)	Mrs. Behrens	5	1	0	220
Forest Hill (The Nurseries)	James Carter & Co.	6	0	6	76
Forest Hill (S. & V. Water Co.)	J. W. Restler	5	1	0	344
Eltham (High Street)	W. Morris	5	1	0	245
Woolwich (Powis Street)	J. G. Waller	5	30	0	65
Greenwich (Royal Observatory)	Astronomer Royal	8	0	5	155
Deptford (Kent Water Co.)	W. Morris	5	1	0	20
Nunhead (S. & V. Water Co.)	J. W. Restler	5	4	0	176
SURREY—					
Brixton (Acre Lane)	F. Gaster	8	1	0	77
Battersea (S. & V. Water Co.)	J. W. Restler	5	3	0	21

Daily Rainfall. *The 50 years (1841–90) mean at Greenwich for February is 1·48 in.* **February, 1894.**

Day of Mo.	Dorking	Reigate Hill	Upper Gatton	Caterham	Caterham Valley	Marden Park	Westerham	Knockholt	Warling-ham	Coulsdon	Kenley	Purley (Tudor C.)
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·07	·05	·08	·09	·07	·07	·12		·09	·06	·07	·06
2	·22	·17	·19	·22	·20	·16	·25		·20	·18	·23	·21
3	..	..	..	..	..	·01	..		·02	..	·01	..
4	·02	·05	·05	·05	·09	·03	·19		·05	·03	·05	·04
5	·20	·22	·29	·23	·23	·18	·25		·24	·24	·23	·28
6	..	·01	·02	..	..	·01	·03		·03	..	·01	..
7	·08	·07	·09	·12	·04	·04	·06		·09	·04	·06	·04
8	..	..	..	·01	..	..	..		..	..	..	..
9	·07	·06	·08	·05	·07	·02	·07		·04	·02	·02	·03
10	..	..	..	..	·02	..	..		·01	..	..	·01
11	·10	·09	·16	·11	·11	·03	·15		·15	·11	·22	·12
12	..	..	·01	..	..	..	..		..	..	..	..
13	..	..	..	..	..	..	..		..	..	..	..
14	·10	·08	·10	·04	·07	·03	·02	MONTHLY GAUGE.	·04	·03	·03	·04
15	..	..	·01	..	..	..	·06		..	..	·01	·02
16	..	·01	·02	·04	·05	·06	·02		..	..	·05	·03
17	·50	·48	·46	·45	·29	·36	·36		·47	·27	·44	·62
18	..	..	..	..	..	..	..		..	..	..	..
19	..	·01	..	..	..	..	..		..	..	..	..
20	..	..	..	..	..	..	..		..	..	..	..
21	..	·01	..	..	..	..	..		..	..	..	..
22	..	..	..	..	..	..	..		..	..	..	..
23	·26	·17	·22	·33	·12	·25	·23		·29	·14	·23	·15
24	..	..	..	..	..	..	..		..	..	·01	..
25	·12	·18	·17	·20	·21	·17	·22		·17	·07	·15	·09
26	·02	..	·02	·03	·04	·01	·01		·02	..	·01	·03
27	·08	·18	·14	·22	·27	·15	·12		·11	·11	·20	·06
28	·06	·04	·06	·05	·09	·05	·21		·09	·07	·03	·08
*	1·90	1·88	2·17	2·24	1·97	1·63	2·37	2·08	2·11	1·37	2·06	1·91
†	6·18	5·75	7·10	7·32	6·20	5·22	6·40	4·33	6·62	5·07	6·19	5·37

Day of Mo.	Ashtead	Oxshott	Epsom	Banstead	Sutton	Wallington	Bedding-ton	Waddon	Croydon (Brim. Bn.)	Croydon (Wn.N.rd.)	Croydon Duppas H.	Croydon Chatfld.rd.	Croydon (Whitgift)	Croydon (Park Hill)
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·07	·07	·07	·05	·06	·07	·07	·07	·08	·06	·07	·06	·07	·06
2	·22	·21	·23	·19	·18	·18	·18	·18	·20	·16	·18	·15	·18	·18
3	..	..	..	..	..	..	..	..	..	..	·01	..	..	..
4	·02	·02	·03	·02	·05	·03	·03	·03	·03	·06	·02	..	·03	·03
5	·21	·18	·24	·28	·27	·28	·26	·26	·29	·21	·25	·31	·28	·28
6	·01	..	..	..	..	..	..	..	..	..	·01	..	..	..
7	·03	·03	·04	·04	·05	·06	·04	·04	·03	·03	·03	·03	·03	·04
8	..	..	..	..	..	..	..	..	..	..	..	..	..	..
9	·02	·02	·02	·02	..	..	..	..	·01	..	..	..	·01	·01
10	..	..	..	..	..	..	..	..	..	..	..	..	..	..
11	·15	·12	·14	·19	·07	·07	·06	·05	·05	·05	·05	·06	·06	·06
12	·01	..	..	..	..	..	..	..	..	..	..	..	..	..
13	..	..	..	..	..	..	..	..	..	..	..	..	..	..
14	·05	·05	·04	·03	·04	·03	·03	·03	..	·03	·03	·03	·03	·02
15	..	..	..	..	..	..	..	..	..	..	·01	..	..	..
16	·01	..	..	·01	·05	·03	·03	·03	..	·06	·04	·03	·04	·04
17	·51	·48	·52	·53	·57	·61	·60	·56	·61	·48	·53	·52	·55	·56
18	..	..	..	..	..	..	..	..	..	..	..	..	..	..
19	..	..	..	..	..	..	..	..	..	..	..	..	..	..
20	..	..	..	..	..	..	..	..	..	..	..	..	..	..
21	..	..	..	..	..	..	..	..	..	..	..	..	..	..
22	..	..	..	..	..	·01	..	..	..	..	..	..	..	..
23	·17	·16	·14	·15	·19	·20	·19	·13	·20	·16	·18	·13	·18	·19
24	..	..	..	..	..	..	..	..	..	·01	·01	..	..	..
25	·07	·07	·08	·10	·10	·11	·11	·11	·13	·10	·12	·09	·12	·13
26	·01	·01	.01	·01	·01	·01	..	..	..	..	..	..	·01	·01
27	·06	·06	·04	·04	·07	·03	·03	·05	..	·12	·05	·03	·05	·07
28	·13	·14	·10	·11	·08	·10	·11	·10	·15	·01	·09	·10	·10	·10
*	1·75	1·62	1·70	1·77	1·79	1·82	1·74	1·64	1·78	1·54	1·68	1·54	1·74	1·78
†	4·67	4·33	5·22	5·20	4·97	4·85	4·57	4·16	4·62	4·09	4·55	4·11	4·61	4·61

* The figures in this row give the totals for the month. † The totals from January 1st.

Daily Rainfall. *The 50 years (1841–90) mean at Greenwich for February is 1·48 in.* **February, 1894.**

Day of Mo.	Croydon (Outm.Rd.)	Addington Hills	Addington (Park Fm.	Addington (Pump.St.)	W.Wickhm Wickhm.C.	W.Wickhm Layhms.F.	Hayes Common	Keston (Bradfield)	Keston (Tow. Fds.)	Orpington	Farning-ham Hill	Wilming-ton	Bickley
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·06	·07	·10	·07	·08	·07	·07	·06	·07	·07	·06	·06	·10
2	·17	·19	·20	·19	·17	·21	·17	·14	·20	·18	·18	·16	·20
3	..	..	..	..	..	·01	..	..	..	..	..	..	..
4	·03	·03	·03	·04	·03	·02	·02	·02	·03	·03	·02	..	·02
5	·28	·29	·29	·25	·28	·27	·24	·25	·31	·21	·21	·18	·28
6	..	..	..	..	..	..	..	..	..	..	..	..	..
7	·03	·05	·04	·05	·04	·03	·03	·02	·04	·03	·01	..	·02
8	..	..	..	..	..	..	..	..	..	..	..	..	..
9	·01	..	·01	·01	..	·01	..	..	..	..	·01	·02	·02
10	..	..	..	..	..	..	..	..	..	..	..	..	..
11	·07	·07	·11	·13	·09	·14	·08	·04	·09	·12	·11	·05	·07
12	..	..	..	..	..	..	..	..	..	..	..	..	..
13	..	..	..	..	..	..	..	..	..	..	..	..	..
14	·02	·02	·01	·01	·01	·02	·02	·02	·03	·01	·06	·10	·04
15	..	..	..	..	..	..	..	..	..	..	·01	·01	..
16	·03	·04	·02	·03	·06	·03	·04	·03	·04	·04	·03	·02	·04
17	·55	·55	·55	·49	·60	·46	·54	·54	·52	·48	·37	·32	·48
18	..	..	..	..	..	..	..	..	..	..	..	..	..
19	..	..	..	..	..	..	..	..	..	..	..	..	..
20	..	..	..	..	..	..	..	..	..	..	..	..	..
21	..	..	..	..	..	..	..	..	..	..	..	..	..
22	..	·01	..	..	..	..	..	..	..	..	..	..	..
23	·18	·21	·23	·20	·25	·24	·18	·15	·22	·20	·14	·18	·20
24	..	..	·01	..	..	..	..	..	..	..	..	..	..
25	·13	·14	·15	·14	·16	·15	·14	·09	·16	·14	·13	·11	·18
26	·01	·01	·02	·01	..	..	..	..	..	..	..	..	..
27	·06	·08	·02	·10	·06	·04	·07	·07	·12	·12	·10	·11	·05
28	·11	·12	·18	·10	·17	·12	·13	·17	·09	·08	·12	·06	·14
*	1·74	1·88	1·97	1·82	2·20	1·82	1·73	1·60	1·92	1·71	1·56	1·38	1·84
†	4·56	4·78	5·28	5·12	5·32	5·69	4·50	4·25	5·31	4·66	4·56	3·39	4·38

Day of Mo.	Bromley	Bromley Common	Beckenham (Foxgrove)	Beckenham (Cedars rd.)	South Norwood	Thornton Heath	Wimbledon (Sew. Wks.)	Wimbledon (Mt. Ararat)	Raynes Park	New Malden	Esher	Surbiton	Kingston
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·08	·08	·07	·06	·06	·06	·05	·09	·10	·04	·04	·04	·06
2	·19	·16	·19	·15	·16	·17	·13	·26	·16	·12	·09	·06	·15
3	·01	·01	..	..	..	..	..	..	..	..	..	..	..
4	·03	·01	·03	·03	·02	·07	·02	·02	·05	·02	·02	·03	·03
5	·28	·23	·27	·28	·34	·25	·29	·32	·30	·23	·14	·21	·23
6	·01	·01	..	..	..	..	·01	..	·01	..	·01	..	..
7	·03	..	..	·03	·03	·01	·02	·02	·05	·02	·04	·03	·04
8	..	..	·01	..	..	..	·01	..	..	..	..	..	..
9	·03	·02	·02	·02	·01	..	·01	·01	·03	..	·02	..	·01
10	·01	..	..	..	..	..	..	..	..	..	..	..	..
11	·07	·05	·05	·06	·06	·05	·08	·11	·10	·04	·07	·06	·11
12	·01	..	..	..	..	..	..	..	..	..	..	..	..
13	..	..	..	..	..	..	..	..	..	..	..	..	..
14	·02	·04	·04	·03	·03	·03	·05	·07	·08	·05	·07	·05	·08
15	·02	..	..	..	..	..	..	..	·02	..	·01	..	..
16	·04	·04	·04	·04	·04	·05	·02	·02	·04	·02	..	..	·02
17	·45	·47	·40	·42	·48	·49	·42	·47	·48	·45	·43	·52	·56
18	..	..	..	..	..	..	..	..	..	..	·02	..	..
19	..	..	..	..	..	..	..	..	..	..	·03	..	..
20	..	..	..	..	..	..	..	..	..	..	..	..	..
21	..	..	..	..	..	..	..	..	..	..	..	..	..
22	..	..	..	..	..	..	..	..	..	..	..	..	..
23	·20	·17	·17	·15	·17	·17	·15	·16	·20	·12	·11	·16	·20
24	·01	·01	..	..	..	..	..	..	·02	..	..	..	·01
25	·19	·16	·19	·15	·15	·12	·12	·11	·12	·07	·06	·06	·08
26	·01	·01	..	..	·01	..	·01	..	·02	..	·02	..	·01
27	·03	·06	·05	·05	·04	·01	·08	·07	·07	·05	·05	·07	·10
28	·18	·16	·12	·13	·12	·12	·14	·16	·16	·13	·10	·10	·12
*	1·90	1·69	1·65	1·60	1·72	1·60	1·61	1·89	2·01	1·36	1·33	1·39	1·81
†	4·42	4·27	4·24	4·33	4·33	4·41	4·69	4·92	5·56	3·81	4·20	4·53	5·16

* The figures in this row give the totals for the month. † The totals from January 1st.

Daily Rainfall. *50 years (1841·90) mean for Greenwich for Feb. is 1·48 in.* **February, 1894.**

Day of Mo.	Richmond	Wandswth. Common	Streatham Hill	West Norwood	Forest Hill Dartmh.rd.	Forest Hill (Nurseries)	Forest Hill S &V. W.C.	Eltham	Woolwich	Greenwich	Deptford	Nunhead	Brixton	Battersea
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·08	·08	·07	·07	·07	·09	·08	·07	·06	·07	·08	·05	·08	·07
2	·09	·11	·13	·16	·13	·16	·14	·13	·10	·10	·09	·09	·11	·09
3	..	·01	·01	..	..	·01	..	..	..	..	..	..	..	..
4	·03	·03	·03	·03	·01	·02	·04	·01	·02	·03	·01	·02	·02	·02
5	·19	·28	·28	·27	·29	·26	·26	·23	·22	·23	·22	·23	·29	·24
6	..	·01	·01	..	..	·02	..	..	..	..	..	..	..	..
7	·03	·03	·02	·03	..	·03	·04	·03	·03	·01	·01	..	·02	·02
8	..	..	..	..	..	..	..	..	..	..	..	..	..	..
9	·02	·03	·03	·01	..	..	·03	·02	·02	·01	·01	..	·01	·01
10	..	·01	..	..	..	..	..	..	..	..	..	..	..	..
11	·11	·09	·08	·11	·13	·11	·10	·08	·10	·12	·13	·08	·10	·14
12	..	·01	..	..	..	..	..	..	..	..	..	..	..	..
13	..	..	..	..	..	..	..	..	..	..	..	..	..	..
14	·07	·05	·04	·04	·06	·05	·05	·05	·07	·06	·05	·04	·04	·03
15	·01	·02	·01	..	..	..	·01	·01	·02	·01	..	·01	·01	..
16	·03	·03	·04	·03	·04	·03	·03	·03	·06	·04	·04	·04	·02	·02
17	·47	·42	·39	·41	·38	·40	·27	·35	·32	·37	·34	·37	·42	·30
18	..	..	..	..	..	..	..	..	..	..	..	..	..	..
19	..	..	..	..	..	..	..	..	..	..	..	..	..	..
20	..	..	..	..	..	..	..	..	..	..	..	..	..	..
21	..	..	..	..	..	..	..	..	..	..	..	..	..	..
22	..	..	..	..	..	..	..	..	..	..	..	..	..	..
23	·18	·17	·15	·19	·16	·22	·19	·23	·22	·21	·20	·16	·20	·16
24	..	·01	·01	..	..	..	..	..	..	..	..	..	..	..
25	·10	·14	·14	·16	·17	·17	·18	·16	·11	·12	·14	·13	·16	·13
26	·02	·02	·01	·01	·01	·04	·02	·01	..	..	..	..	·01	·01
27	·14	·09	·09	·09	·07	·02	·08	·03	·07	·08	·06	·07	·02	..
28	·10	·16	·12	·11	·13	·17	·12	·13	·15	·13	·14	·14	·21	·21
*	1·67	1·80	1·66	1·72	1·65	1·80	1·64	1·57	1·57	1·59	1·52	1·43	1·72	1·45
†	4·90	4·89	4·64	4·49	4·43	4·69	4·37	4·10	4·59	4·67	4·40	3·66	4·89	3·91

* The figures in this row give the totals for the month. † The totals from January 1st.

Note.—The observations are taken at 9 a.m., except at Brixton and Addington Park Farm (8 a.m.), Bromley (8.30 a.m.), South Norwood (8.45 a.m.), and Croydon (Waddon New Road) (10 a.m.).

NOTES.

(February, 1894.)

The month has been unusually warm, sunny, and wet. The coldest days in the district were between the 19th and 23rd. The season is about 14 days earlier than usual. The yellow crocus was in full bloom at Warlingham on the 9th. The mild weather has, however, given rise to a good deal of sickness. The mean temperature was at Waddon 41·2°, and at Wallington 41·6°, being about 5° above the average. On the evening of the 28th an aurora was seen at Warlingham and Wallington from about 6.45 to 9. At Wallington the sun shone for 81 hours, being 29 per cent. of the possible duration, and 8 per cent. above the mean.

Francis Campbell Bayard, F.R.Met. Soc.,
Hon. Sec.

CROYDON MICROSCOPICAL AND NATURAL HISTORY CLUB *(Meteorological Subcommittee).*

Stations.	Observers.	Size of Gauge.	Height above Ground.		Height of Statn. ab. Sea-level.
		IN.	FT.	IN.	FT.
SURREY—					
Dorking (Denbies)	J. Beesley	5	0	6	610
Reigate Hill (Margery Hall)	W. F. Taylor	5	2	0	756
Upper Gatton	F. Druce	5	1	0	600
Caterham (Metropol. Asylum)	G. S. Elliott, M.D.	5	1	0	610
Caterham Valley (Congreg. Shl.)	Miss S. W. Rudd	5	1	0	500
Marden Park (Birchwood House)	Mrs. F. Rutley	5	1	0	471
KENT—					
Westerham (The Fishponds)	W. Morris	5	1	0	380
Knockholt (The Beeches)	W. Morris	5	1	0	785
SURREY—					
Warlingham (The Vicarage)	Rev. F. R. Marriott	5	1	0	614
Coulsdon (The Grange)	W. J. Stride	5	1	4	525
Kenley (Ingleside)	H. Smith	8	1	0	375
Purley (Tudor Cottages)	J. Bonwick	5	1	0	216
Ashtead (D'Abernon Chase)	Rev. Sir W. Vincent, Brt.	5	1	0	280
Oxshott	W. H. Dines	5	1	0	212
Epsom (Epsom College)	C. J. Gardiner	8	1	0	290
Banstead (The Larches)	Rev. C. J. Taylor	8	1	0	488
Sutton (Mulgrave Road)	W. Goode	5	5	6	230
Wallington (Manor Road)	F. C. Bayard	5	4	1	157
Beddington (Riverside)	S. Rostron	5	1	0	120
Waddon (Waddon House)	P. Crowley	5	1	0	156
Croydon (Brimstone Barn)	Croydon Corporation	5	1	0	130
Croydon (Waddon New Road)	Croydon Corporation	5	1	0	146
Croydon (Duppas House)	Baldwin Latham	8	1	0	158
Croydon (Chatfield Road)	A. Malden	5	1	0	166
Croydon (Whitgift School)	A. E. Watson	5	1	0	191
Croydon (Park Hill Rise)	H. F. Parsons, M.D.	5	1	0	250
Croydon (Outram Road)	E. Mawley	8	0	9	202
Addington Hills (The Reservoir)	Croydon Corporation	8	0	9	473
Addington (Park Farm)	W. Whalley	5	1	0	268
Addington (Pumping Station)	Croydon Corporation	8	1	0	331
KENT—					
West Wickham (Wickham Ct.)	Sir J. F. Lennard, Bart.	5	1	2	300
West Wickham (Layham's Fm.)	W. Ashcroft	5	1	0	500
Hayes Common (The Warren)	Miss Akers	5	1	0	296
KENT—					
Keston (Bradfield)	A. Hill	5	1	0	350
Keston (Tower Fields)	G. Buchanan	8	0	9	351
Orpington (Kent Water Co.)	W. Morris	5	1	0	220
Farningham Hill	A. J. Waring	5	3	0	300
Wilmington (Kent Water Co.)	W. Morris	5	1	0	25
Bickley (Highfield)	J. Batten	5	1	2	295
Bromley (Sundridge Avenue)	J. B. Snell	5	1	0	245
Bromley Common (Elmfield)	Rev. J. P. Faunthorpe	5	0	9	240
Beckenham (Foxgrove)	P. Bicknell	5	0	6	142
Beckenham (Cedars Road)	H. Dolling Smith	5	1	0	105
SURREY—					
South Norwood (Selhurst Road)	J. Potter	5	1	0	200
Thornton Heath (Thornton Rd.)	A. Wright	8	0	10	120
Wimbledon (Sewage Works)	C. H. Cooper	5	1	0	58
Wimbledon (Mount Ararat)	T. Devas	12	3	0	157
Raynes Park (Pumping Station)	C. H. Cooper	5	1	0	47
New Malden (Sewage Works)	T. V. H. Davison	5	1	0	45
Esher (Sewage Works)	W. H. Hope	5	1	0	40
Surbiton (Seething Wells)	R. Hack	10	0	6	25
Kingston (Sewage Works)	T. Stevens	5	1	0	25
Richmond (Ormond Lodge)	J. T. Billett	5	0	9	51
Wandsworth Com. (Patten Rd.)	F. J. Brodie	5	1	0	100
Streatham Hill (Wavertree Rd.)	F. Jordan	5	0	10	178
West Norwood (Thornlaw Road)	W. Marriott	8	1	0	220
KENT—					
Forest Hill (Dartmouth Road)	Mrs. Behrens	5	1	0	220
Forest Hill (The Nurseries)	James Carter & Co.	6	0	6	76
Forest Hill (S. & V. Water Co.)	J. W. Restler	5	1	0	344
Eltham (High Street)	W. Morris	5	1	0	245
Woolwich (Powis Street)	J. G. Waller	5	30	0	65
Greenwich (Royal Observatory)	Astronomer Royal	8	0	5	155
Deptford (Kent Water Co.)	W. Morris	5	1	0	20
Nunhead (S. & V. Water Co.)	J. W. Restler	5	4	0	176
SURREY—					
Brixton (Acre Lane)	F. Gaster	8	1	0	77
Battersea (S. & V. Water Co.)	J. W. Restler	5	3	0	21

Daily Rainfall.

The 50 years (1841–90) mean at Greenwich for March is 1·46 in.

March, 1894.

Day of Mo.	Dorking	Reigate Hill	Upper Gatton	Caterham	Caterham Valley	Marden Park	Westerham	Knockholt	Warling-ham	Coulsdon	Kenley	Purley (Tudor C.)	Ashtead	Oxshott	Epsom	Banstead	Sutton	Wallington	Bedding-ton	Waddon	Croydon (Brim. Bn.)	Croydon (Wn.N.rd.)	Croydon Duppas H.	Croydon Chatfd. rd.	Croydon (Whitgift)	Croydon (Park Hill)
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·27	·23	·23	·25	·09	·21	·17		·24	·19	·21	·28	·15	·16	·12	·19	·14	·19	·18	·16	·15	·15	·18	·15	·19	·20
2	..	..	..	..	..	..	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	..
3	..	..	..	..	..	..	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
4	..	..	..	..	..	..	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
5	·08	·05	·07	·06	·05	..	·08		·08	·07	·07	·05	·08	·07	·06	·04	·07	·06	·06	·05	·05	·05	·06	·04	·05	·06
6	..	·01	·01	..	..	..	..		..	..	·02	·02	·01	..	..	..	..	..	..	..	..	..	..	..	..	..
7	·07	·14	·18	·13	·05	·19	·10		·17	·11	..	..	·05	·05	·03	·07	·03	·02	·03	·02	·03	·03	·04	..	·03	·04
8	·29	·25	·29	·29	·13	·15	·19		·21	·21	·22	·14	·21	·16	·24	·17	·16	·19	·18	·18	·16	·18	·19	·19	·19	·20
9	·16	·09	·14	·15	·07	·09	·12		·13	·06	·08	·05	·07	·05	·05	·06	·04	·05	·04	·04	·04	·04	·05	·03	·04	·05
10	..	·01	..	..	·03	·01	..		·03	..	..	·04	·02	..	·02	..	·02	..	..	..	..	..	..	..	·02	..
11	·03	·03	·02	·03	·04	·01	..		·04	..	·02	·03	·01	·02	·03	·05	..	·01	·01	·01	·01	..	·01	·04	..	·02
12	·67	·48	·50	·46	·42	·26	·34		·42	·37	·54	·33	·34	·30	·43	·49	·37	·47	·44	·34	·39	·35	·36	·32	·38	·39
13	·03	·07	·07	·04	·05	·04	·02	MONTHLY GAUGE.	·05	·03	·07	·10	·08	·08	·07	·07	·05	·04	·04	·04	·04	·04	·04	·04	·04	·03
14	·28	·21	·25	·21	·15	..	·24		·23	·22	·22	·21	·21	·21	·22	·22	·21	·15	·15	·14	·14	·13	·14	·13	·15	·13
15	·02	..	..	·01	·01	..	·02		·03	..	..	·02	..	..	..	..	..	..	..	·01	·02	·01	·01	·01	·01	..
16	..	·02	·01	..	..	·01	..		..	..	..	..	..	..	·01	..	..	..	..	..	..	..	·01	..	·01	·01
17	..	..	..	..	..	..	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
18	..	..	..	..	..	..	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	..
19	..	..	..	..	..	..	..		..	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	..
20	..	..	..	..	..	..	..		..	..	·01	..	..	..	..	..	..	·01	..	..	..	..	·01	..	..	..
21	..	..	..	..	..	..	..		..	..	..	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..
22	..	..	..	..	..	..	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
23	..	..	..	..	..	..	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
24	..	..	..	..	..	..	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	..
25	..	..	..	..	..	..	..		..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	..	..	..
26	..	..	..	..	..	..	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..
27	..	..	..	..	..	..	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
28	..	..	..	..	..	..	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
29	..	..	..	..	..	..	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..
30	·04	..	·03	..	..	..	..		·01	·02	..	·02	·05	·06	..	·02	·03	·02	..	..	..	..	..	..	..	·01
31	..	..	..	..	..	..	..		..	..	·05	..	..	..	..	..	..	..	·01	..	·03	..	..	·01	..	..
*	1·94	1·59	1·80	1·63	1·09	·97	1·28	1·55	1·64	1·28	1·51	1·29	1·28	1·16	1·28	1·39	1·12	1·22	1·14	1·00	1·06	·98	1·13	·96	1·13	1·14
†	8·12	7·34	8·90	8·95	7·29	6·19	7·68	5·88	8·26	6·35	7·70	6·66	5·95	5·49	6·50	6·59	6·09	6·07	5·71	5·16	5·68	5·07	5·68	5·07	5·74	5·75

* The figures in this row give the totals for the month. † The totals from January 1st.

Daily Rainfall. *The 50 years (1841–90) mean at Greenwich for March is 1·46 in.* **March, 1894.**

Day of Mo.	Croydon (Outm.Rd.)	Addington Hills	Addington (Park Fm.)	Addington (Pump.St.)	W.Wickhm Wickhm.C.	W.Wickhm Layhms.F.	Hayes Common	Keston (Bradfield)	Keston (Tow. Fds.)	Orpington	Farning-ham Hill	Wilming-ton	Bickley	Bromley	Bromley Common	Beckenham (Foxgrove)	Beckenham (Cedarsrd.)	South Norwood	Thornton Heath	Wimbledon (Sew. Wks.)	Wimbledon (Mt.Ararat)	Raynes Park	New Malden	Esher	Surbiton	Kingston
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·20	·22	·25	·23	·25	·19	·18	·17	·19	·15	·08	·03	·10	·12	·13	·10	·11	·13	·14	·13	·15	·17	·10	·12	·13	·18
2	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..
3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
4	..	..	..	..	..	..	..	..	..	..	..	..	·01	·02	·01	·01	·01	..	..	..	..	..	..	..	..	..
5	·06	·06	·06	·06	·05	·05	·04	·03	·05	·03	·03	·02	·04	·05	·04	·05	·04	·06	·06	·06	·08	·09	·05	·08	·06	·08
6	·01	..	·01	..	..	..	..	..	..	..	..	..	·01	·02	·01	..	..	..	..	..	..	·02	..	..	..	..
7	·03	·05	·08	·09	·06	·06	·04	·05	·08	·03	·04	·01	·02	·03	·04	·02	·02	·03	·02	..	·03	·05	·02	·02	..	·04
8	·19	·19	·20	·19	·21	·18	·15	·14	·17	·16	·15	·07	·11	·12	·13	·11	·11	·14	·17	·10	·12	·15	·01	·13	·20	·13
9	·05	·06	·06	·06	·05	·06	·04	·03	·05	·03	·02	..	·02	·03	·04	·02	·02	·04	·02	..	·02	·05	..	·03	·02	·02
10	·01	..	·01	..	..	..	..	·03	..	..	..	..	..	·02	·01	·01	·01	·05	·01	·02	·01	·07	·03	·02	..	·03
11	·01	·05	·04	·03	·05	·01	·03	..	·05	·01	·02	..	·01	·02	·02	·06	·02	·03	·01	·03	..	..	..	·01	..	..
12	·41	·43	·48	·44	·53	·37	·40	·28	·45	·39	·30	·15	·36	·38	·30	·31	·31	·38	·33	·24	·27	·31	·23	·25	·32	·38
13	·03	·06	·12	·09	·10	·04	·09	·05	·07	·08	·03	..	·02	·03	·04	·01	·02	·06	·02	·04	·04	·06	·03	·04	·03	·03
14	·13	·14	·16	·19	·18	·18	·15	·17	·18	·19	·20	·13	·12	·11	·15	·12	·14	·12	·15	·12	·15	·17	·15	·20	·20	·25
15	..	..	·01	..	..	·01	..	..	..	..	·02	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..
16	·01	·01	..	·01	..	..	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..
17	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..
18	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
19	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	·01	..	..	..	..	..
20	..	..	·01	..	..	..	·01	..	·01	..	..	..	·01	·01	·01	..	..	·01	·01	..	..	·01	..	..	..	..
21	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
22	..	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
23	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	·01	..	·01	..	..	..	..	..	..	..
24	·01	..	..	..	..	·01	..	..	..	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..
25	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..
26	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
27	..	..	..	..	..	..	..	..	..	..	·01	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..
28	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
29	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..
30	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	·02	..	·03	..	·02
31	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	·01	..	·01	..	·02
*	1·15	1·27	1·50	1·40	1·48	1·17	1·13	·95	1·30	1·07	·92	·41	·83	1·02	·94	·82	·82	1·05	·95	·74	·90	1·20	·62	·94	·96	1·18
†	5·71	6·05	6·78	6·52	6·80	6·86	5·63	5·20	6·61	5·73	5·48	3·80	5·21	5·44	5·21	5·06	5·15	5·38	5·36	5·43	5·82	6·76	4·43	5·14	5·49	6·34

* The figures in this row give the totals for the month. † The totals from January 1st.

Daily Rainfall. *50 years (1841-90) mean for Greenwich for Mar. is 1·46 in.* **March, 1894.**

Day of Mo.	Richmond	Wandswth. Common	Streatham Hill	West Norwood	Forest Hill Dartmh.rd.	Forest Hill (Nurseries)	Forest Hill S.&V.W.C.	Eltham	Woolwich	Greenwich	Deptford	Nunhead	Brixton	Battersea
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·14	·16	·12	·15	·11	·11	·12	·10	·10	·11	·11	·07	·18	·11
2	..	..	..	..	..	..	..	..	..	..	..	..	..	..
3	..	·01	..	..	..	..	..	..	..	..	..	..	..	..
4	..	·01	·02	·01	..	·02	·02	..	..	..	..	..	·01	..
5	·09	·07	·06	·06	·08	·06	·06	·05	·06	·06	·06	·03	·08	·07
6	..	..	..	..	..	..	·02	..	..	·01	·01	..	..	·01
7	·05	·04	·03	·04	·04	·03	·03	·01	·02	·03	·02	·02	·03	·01
8	·15	·11	·09	·11	·10	·11	·10	·08	·06	·08	·08	·07	·10	·10
9	·03	·03	·02	·02	·04	·02	·03	·02	·02	·01	·01	..	·02	·02
10	..	·01	·02	·04	·02	·02	·04	·03	..	·01	·01	..	·01	..
11	·02	·03	..	·01	·02	·04	..	..	·02	·02	·01	·01	·02	·03
12	·27	·26	·22	·29	·22	·34	·25	·28	·19	·20	·20	·15	·31	·23
13	·11	·06	·04	·02	·04	·03	·03	·01	·04	·05	·05	·03	·06	·04
14	·33	·13	·13	·13	·17	·14	·14	·10	·13	·14	·11	·14	·15	·15
15	..	·02	..	..	..	..	..	·06	·02	..	..	..	..	..
16	..	·01	..	..	..	..	..	..	..	..	..	..	..	..
17	..	..	..	..	..	..	..	..	..	..	..	..	..	..
18	..	..	..	..	..	..	..	..	..	..	..	..	..	..
19	..	..	..	..	..	..	..	..	..	..	..	..	..	..
20	..	..	..	·01	..	·02	..	..	..	..	..	..	..	..
21	..	..	..	..	..	..	..	..	..	..	..	..	..	..
22	..	..	..	..	..	..	..	..	..	..	..	..	..	..
23	..	..	..	..	..	..	..	..	..	..	..	..	..	..
24	..	..	..	..	..	..	..	..	..	..	..	..	..	..
25	..	..	..	..	..	..	..	..	..	..	..	..	..	..
26	..	..	..	..	..	·02	..	..	..	..	..	..	..	..
27	..	..	..	..	..	·01	..	..	..	..	..	..	..	..
28	..	..	..	..	..	..	..	..	..	..	..	..	..	..
29	..	..	..	..	..	..	..	..	..	..	..	..	..	..
30	·01	·02	·02	..	..	·01	..	..	..	..	..	..	..	..
31	..	..	..	·01	·02	·02	..	·02	..	..	..	..	..	..
*	1·20	·97	·77	·90	·86	1·00	·84	·76	·66	·72	·67	·52	·97	·77
†	6·10	5·86	5·41	5·39	5·29	5·69	5·21	4·86	5·25	5·39	5·07	4·18	5·86	4·68

* The figures in this row give the totals for the month. † The totals from January 1st.

Note.—The observations are taken at 9 a.m., except at Brixton and Addington Park Farm (8 a.m.), Bromley (8.30 a.m.), South Norwood (8.45 a.m.), and Croydon (Waddon New Road) (10 a.m.).

NOTES.

(March, 1894.)

The month may be divided into two portions, the first half wet, and the second part very dry, and but for the light showers on the 30th and 31st there would have been an absolute drought. The season was at Warlingham about 10 days earlier than last year during the first half of the month, but towards the end of the month this excess was gradually lost. At Wallington on the 3rd a honey bee was seen, and the almond was in blossom; and at Norwood the gorse. On the 21st at Wallington a small tortoiseshell butterfly was seen, and on the 23rd a wasp was seen and killed, and on the 31st a small white butterfly was seen. On the 30th, in many parts of England, there was a fine display of the aurora borealis. The mean temperature of the month was at Croydon 45°, at Wallington 44·9°, at Waddon 44·2°, and at Warlingham 42°, being about 3° above the average. There were at Wallington 176·4 hours of sunlight recorded by the Jordan Photographic Recorder, which is 18 per cent. above the mean.

Francis Campbell Bayard, F.R.Met.Soc.,
Hon. Sec.

CROYDON MICROSCOPICAL AND NATURAL HISTORY CLUB *(Meteorological Subcommittee)*.

Stations.	Observers.	Size of Gauge.	Height above Ground.		Height of Statn. ab. Sea-level.
		IN.	FT.	IN.	FT.
Surrey—					
Dorking (Denbies)	J. Beesley	5	0	6	610
Reigate Hill (Margery Hall)	W. F. Taylor	5	2	0	756
Upper Gatton	F. Druce	5	1	0	600
Caterham (Metropol. Asylum)	G. S. Elliott, M.D.	5	1	0	610
Caterham Valley (Congreg. Shl.)	Miss S. W. Rudd	5	1	0	500
Marden Park (Birchwood House)	Mrs. F. Rutley	5	1	0	471
Kent—					
Westerham (The Fishponds)	W. Morris	5	1	0	380
Knockholt (The Beeches)	W. Morris	5	1	0	785
Surrey—					
Warlingham (The Vicarage)	Rev. F. R. Marriott	5	1	0	614
Coulsdon (The Grange)	W. J. Stride	5	1	4	525
Kenley (Ingleside)	H. Smith	8	1	0	375
Purley (Tudor Cottages)	J. Bonwick	5	1	0	216
Ashtead (D'Abernon Chase)	Rev. Sir W. Vincent, Brt.	5	1	0	280
Oxshott	W. H. Dines	5	1	0	212
Epsom (Epsom College)	C. J. Gardiner	8	1	0	290
Banstead (The Larches)	Rev. C. J. Taylor	8	1	0	488
Sutton (Mulgrave Road)	W. Goode	5	5	6	230
Wallington (Manor Road)	F. C. Bayard	5	4	1	157
Beddington (Riverside)	S. Rostron	5	1	0	120
Waddon (Waddon House)	P. Crowley	5	1	0	156
Croydon (Brimstone Barn)	Croydon Corporation	5	1	0	130
Croydon (Waddon New Road)	Croydon Corporation	5	1	0	146
Croydon (Duppas House)	Baldwin Latham	8	1	0	158
Croydon (Chatfield Road)	A. Malden	5	1	0	166
Croydon (Whitgift School)	A. E. Watson	5	1	0	191
Croydon (Park Hill Rise)	H. F. Parsons, M.D.	5	1	0	250
Croydon (Outram Road)	E. Mawley	8	0	9	202
Addington Hills (The Reservoir)	Croydon Corporation	8	0	9	473
Addington (Park Farm)	W. Whalley	5	1	0	268
Addington (Pumping Station)	Croydon Corporation	8	1	0	331
Kent—					
West Wickham (Wickham Ct.)	Sir J. F. Lennard, Bart.	5	1	2	300
West Wickham (Layham's Fm.)	W. Ashcroft	5	1	0	500
Hayes Common (The Warren)	Miss Akers	5	1	0	296

Stations.	Observers.	Size of Gauge.	Height above Ground.		Height of Statn. ab. Sea-level.
		IN.	FT.	IN.	FT.
Kent—					
Keston (Bradfield)	A. Hill	5	1	0	350
Keston (Tower Fields)	G. Buchanan	8	0	9	351
Orpington (Kent Water Co.)	W. Morris	5	1	0	220
Farningham Hill	A. J. Waring	5	3	0	300
Wilmington (Kent Water Co.)	W. Morris	5	1	0	25
Bickley (Highfield)	J. Batten	5	1	2	295
Bromley (Sundridge Avenue)	J. B. Snell	5	1	0	245
Bromley Common (Elmfield)	Rev. J. P. Faunthorpe	5	0	9	240
Beckenham (Foxgrove)	P. Bicknell	5	0	6	142
Beckenham (Cedars Road)	H. Dolling Smith	5	1	0	105
Surrey—					
South Norwood (Selhurst Road)	J. Potter	5	1	0	200
Thornton Heath (Thornton Rd.)	A. Wright	8	0	10	120
Wimbledon (Sewage Works)	C. H. Cooper	5	1	0	58
Wimbledon (Mount Ararat)	T. Devas	12	3	0	157
Raynes Park (Pumping Station)	C. H. Cooper	5	1	0	47
New Malden (Sewage Works)	T. V. H. Davison	5	1	0	45
Esher (Sewage Works)	W. H. Hope	5	1	0	40
Surbiton (Seething Wells)	R. Hack	10	0	6	25
Kingston (Sewage Works)	T. Stevens	5	1	0	25
Richmond (Ormond Lodge)	J. T. Billett	5	0	9	51
Wandsworth Com. (Patten Rd.)	F. J. Brodie	5	1	0	100
Streatham Hill (Wavertree Rd.)	F. Jordan	5	0	10	178
West Norwood (Thornlaw Road)	W. Marriott	8	1	0	220
Kent—					
Forest Hill (Dartmouth Road)	Mrs. Behrens	5	1	0	220
Forest Hill (The Nurseries)	James Carter & Co.	6	0	6	76
Forest Hill (S. & V. Water Co.)	J. W. Restler	5	1	0	344
Eltham (High Street)	W. Morris	5	1	0	245
Woolwich (Powis Street)	J. G. Waller	5	30	0	65
Greenwich (Royal Observatory)	Astronomer Royal	8	0	5	155
Deptford (Kent Water Co.)	W. Morris	5	1	0	20
Nunhead (S. & V. Water Co.)	J. W. Restler	5	4	0	176
Surrey—					
Brixton (Acre Lane)	F. Gaster	8	1	0	77
Battersea (S. & V. Water Co.)	J. W. Restler	5	3	0	21

Day of Mo.	Dorking	Reigate Hill	Upper Gatton	Caterham	Caterham Valley	Marden Park	Westerham	Knockholt	Warling-ham	Coulsdon	Kenley
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	..	..	..	..	..	..	MONTHLY GAUGE.	..	..	..
2	..	..	..	..	..	..	..		..	..	·01
3	..	..	..	..	..	..	..		..	..	..
4	..	..	..	..	..	..	..		..	..	..
5	..	..	..	..	..	..	..		..	..	..
6	..	..	..	..	..	..	..		..	..	..
7	..	..	..	..	..	..	·08		..	..	..
8	..	..	..	..	..	..	..		..	..	..
9	..	..	·01	..	..	..	..		..	..	..
10	..	..	..	..	..	..	..		..	..	..
11	..	·02	·07	..	..	·01	·02		..	..	..
12	..	..	..	..	..	..	..		..	..	..
13	..	..	..	..	..	..	..		..	..	..
14	·35	·33	·38	·32	1·21	·20	·20		·24	·34	·32
15	·26	·26	·40	·43	·28	·27	·21		·34	·31	·38
16	·19	·08	·09	·10	·07	·18	·03		·20	·08	·07
17	·08	·01	·01	·02	..	·04	..		·06	·04	·03
18	·05	·15	·21	·05	·02	·05	·08		·09	·43	·21
19	..	..	..	..	..	..	..		..	..	..
20	..	..	..	..	..	..	..		..	..	..
21	..	..	..	..	..	..	..		..	..	..
22	..	..	..	..	..	..	..		..	..	..
23	..	·01	·02	..	..	..	·02		·03	..	·01
24	1·00	·82	·85	·93	·66	·65	·73		·79	·82	·86
25	·14	·12	·17	·21	·15	·28	·17		·25	·21	·18
26	·12	·13	·19	·18	·17	·19	·16		·22	·17	·18
27	..	·02	·02	·01	·02	..	..		..	·03	·02
28	..	·02	·03	·13	·10	·13	·11		·18	·06	·06
29	·03	·02	·02	·01	·03	..	·05		..	..	·01
30	·09	·10	·13	·09	·07	·04	·11		·14	·11	·13
*	2·31	2·09	2·60	2·48	2·78	2·04	1·97	2·95	2·54	2·60	2·47
†	10·43	9·43	11·50	11·43	10·07	8·23	9·65	8·83	10·80	8·95	10·17

Day of Mo.	Purley (Tudor C.)	Ashtead	Oxshott	Epsom	Banstead	Sutton	Wallington	Bedding-ton	Waddon	Croydon (Brim. Bn.)	Croydon (Wn.N.rd.)	Croydon Duppas H.	Croydon Chatfd. rd.	Croydon (Whitgift)	Croydon (Park Hill)
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·12	·01	..	·17	·16	·05	·15	·22	·16	·09	·16	·15	·08	·13	·08
2	·02	..	..	..	·03	..	·06	·02	·04	·09	·04	·06	·02	·05	..
3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
4	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
7	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
9	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
11	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	..
12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
13	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
14	·30	·19	·14	·23	·29	·18	·24	·19	·20	·19	·18	·20	·17	·20	·16
15	·19	·20	·16	·26	·43	·28	·22	·17	·17	·16	·16	·17	·15	·17	·24
16	·10	·10	·10	·13	·18	·20	·08	·04	·05	·04	·05	·06	·04	·06	·07
17	·03	·07	·09	·50	·03	·04	·02	·01	·02	·03	·02	·02	·01	·02	·02
18	·06	·20	·15	·20	·14	·06	·04	·03	·04	·03	·03	·04	·02	..	·03
19	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
21	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
22	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
23	..	·01	·01	..	·01	..	..	..	..	..	..	..	..	..	..
24	·70	·55	·45	·82	·98	·82	·81	·72	·66	·65	·64	·69	·65	·63	·67
25	·16	·20	·20	·11	·11	·09	·10	·11	·10	·10	·08	·12	·10	·17	·12
26	·20	·14	·08	·13	·19	·17	·21	·16	·16	·16	·14	·16	·15	·18	·17
27	..	·01	..	..	..	..	..	..	..	·02	..	..	..	..	..
28	·06	..	·05	..	·02	..	·10	·08	·05	·06	·04	·05	·05	·06	·05
29	·02	·04	·04	..	·01	·01	·01	·02	·02	·02	·02	·01	·01	·01	·01
30	·17	·03	·03	·30	·08	·08	·08	·07	·08	·09	·08	·10	·09	·11	·10
*	2·13	1·75	1·50	2·85	2·66	1·98	2·12	1·84	1·76	1·73	1·64	1·83	1·54	1·79	1·72
†	8·79	7·70	6·99	9·35	9·25	8·07	8·19	7·55	6·92	7·41	6·71	7·51	6·61	7·53	7·47

* The figures in this row give the totals for the month. † The totals from January 1st.

Daily Rainfall. *The 50 years (1841–90) mean at Greenwich for April is 1·66 in.* April, 1894.

Day of Mo.	Croydon (Outm. Rd.)	Addington Hills	Addington (Park Fm.)	Addington (Pump. St.)	W. Wickhm Wickhm. C.	W. Wickhm Layhms. F.	Hayes Common	Keston (Bradfield)	Keston (Tow. Fds.)	Orpington	Farning-ham Hill	Wilming-ton	Bickley	Bromley	Bromley Common	Beckenham (Foxgrove)	Beckenham (Cedars rd.)	South Norwood	Thornton Heath	Wimbledon (Sew. Wks.)	Wimbledon (Mt. Ararat)	Raynes Park	New Malden	Esher	Surbiton	Kingston
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·08	·03	·13	·04	·15	·25	·17	·11	·05	·09	·06	..	·02	·04	·08	·08	·07	·04	·06	·04	·05	·05	·08	·28	·25	·13
2	—	..	..	..	·12	·01	·05	·05	·03	..	..	..	·03	·03	·03	·06	·14	·02	·03	..	..	·01	..	·01	..	·22
3	—	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
4	—	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
5	—	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
6	—	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	·01
7	—	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
8	—	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
9	—	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
10	—	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
11	—	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	·03	..	·02
12	—	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
13	—	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
14	·16	·22	·22	·25	·22	·25	·21	·16	·16	·16	·15	·11	·10	·14	·12	·14	·17	·17	·14	·13	·14	·17	·11	·07	·17	·17
15	·24	·22	·23	·27	·30	·20	·21	·24	·23	·27	·25	·15	·15	·19	·20	·16	·18	·15	·14	·15	·18	·20	·17	·16	·14	·17
16	·07	·09	·11	·22	·18	·15	·15	·09	·13	·13	·13	·06	·08	·09	·08	·13	·07	·04	·04	·16	·07	·08	·04	·04	·12	·07
17	·02	·03	·13	·05	·07	·14	·08	..	·07	·03	·02	..	·03	·04	·08	·03	·02	·02	·02	·11	·03	·05	..	·24	·02	·02
18	·02	·03	·05	·10	·04	·17	·05	·05	·05	·02	·06	·03	·03	·02	·06	·01	·01	..	·01	·04	·03	·03	·05	·22	·32	..
19	..	..	·02	..	..	·01	..	·01	·01	·01	·01	..	·01	·01	..	..	..	..	..	..	..	..	..	..	..	..
20	..	..	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
21	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
22	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
23	..	..	..	..	..	·01	..	..	..	..	·02	·01	·01	·01	·02	·01	·01	·01	..	..	..	·02	..	·02	·01	·01
24	·67	·73	·64	·77	·78	·69	·63	·64	·58	·65	·64	·48	·55	·52	·52	·58	·56	·61	·66	·56	·56	·58	·54	·43	·52	·62
25	·11	·16	·25	·16	·20	·22	·12	·16	·22	·05	·07	·03	·09	·12	·12	·09	·11	·12	·11	..	·12	·13	·13	·15	·16	·20
26	·18	·19	·20	·21	·26	·23	·21	·23	·23	·15	·24	·23	·18	·19	·18	·13	·15	·16	·17	·10	·15	·10	·06	·06	·03	·05
27	..	..	..	·01	..	·17	..	·01	·01	·01	·01	..	..	·01	·18	..	..	..	..	·03	·03	·03	·05	·05	..	·04
28	·06	·07	·14	·12	·18	·02	·20	·26	·21	·38	·18	·26	·32	·17	·28	·10	·07	·07	·10	..	·01	·01	·02	·06	·04	·05
29	·01	·01	·01	·01	..	..	·02	·02	·01	·03	·04	·05	·02	·02	·02	·01	·02	·02	·02	·02	·02	·04	·02	·05	·03	·05
30	·12	·12	·11	·11	·14	·13	·12	·11	·11	·12	·20	·14	·14	·12	·11	·10	·11	·09	·11	·04	·06	·06	·04	·02	·02	·02
*	1·74	1·90	2·24	2·32	2·64	2·65	2·23	2·14	2·10	2·10	2·08	1·55	1·76	1·72	2·08	1·63	1·69	1·52	1·61	1·38	1·45	1·57	1·32	1·89	1·83	1·85
†	7·45	7·95	9·02	8·84	9·44	9·51	7·86	7·34	8·71	7·83	7·56	5·35	6·97	7·16	7·29	6·69	6·84	6·90	6·97	6·81	7·27	8·33	5·75	7·03	7·32	8·19

* The figures in this row give the totals for the month. † The totals from January 1st.

Daily Rainfall. *50 years (1841-90) mean for Greenwich for April is 1·66 in.* **April, 1894.**

Day of Mo.	Richmond	Wandswth. Common	Streatham Hill	West Norwood	Forest Hill Dartmh.rd.	Forest Hill (Nurseries)	Forest Hill S.&V.W.C.	Eltham	Woolwich	Greenwich	Deptford	Nunhead	Brixton	Battersea
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	·01	..	..	..	..	·02	·02	..	..	..	..	·02	..
2	·06	..	..	·04	·04	·02	..	·03	·09	·01	..	..	..	..
3	..	..	..	..	..	..	..	..	..	..	..	..	..	..
4	..	..	..	..	..	..	..	..	..	..	..	..	..	..
5	..	..	..	..	..	..	..	..	..	·01	..	..	..	..
6	·01	..	..	..	..	..	..	..	..	..	..	..	..	..
7	..	..	..	..	..	..	..	..	..	..	..	..	..	..
8	..	..	..	..	..	..	..	..	..	..	..	..	..	..
9	..	..	..	..	..	..	..	..	..	..	..	..	..	..
10	..	..	..	..	..	..	..	..	..	..	..	..	..	..
11	..	..	..	..	..	..	..	..	..	·01	..	..	..	..
12	..	..	..	..	..	..	..	..	..	..	..	..	..	..
13	..	..	..	..	..	..	..	..	..	..	..	..	..	..
14	·13	·12	·12	·12	·10	·12	·13	·08	·07	·08	·10	·12	·12	·11
15	·20	·13	·15	·10	·09	·05	·13	·23	·17	·16	·13	·13	·16	·16
16	·07	·16	·03	·04	·04	..	·04	·03	·02	·05	·01	·02	·03	·05
17	·09	·21	·02	·03	..	..	·03	·01	..	·04	·02	·02	·02	·10
18	·05	·04	·05	·02	..	..	·01	..	..	..	·01	·03	·02	..
19	..	..	·01	..	..	..	..	..	..	..	..	..	..	..
20	..	..	..	..	..	..	..	..	..	..	..	..	..	..
21	..	..	..	..	..	..	..	..	..	..	..	..	..	..
22	..	..	..	..	..	..	..	..	..	..	..	..	..	..
23	·02	·02	·01	..	·03	..	·01	·01	·02	·01	..	..	·01	..
24	·57	·52	·63	·64	·63	·43	·64	·50	·46	·55	·53	·62	·58	·59
25	·17	·09	·09	·07	·14	·28	·12	·08	·07	·11	·11	·10	·24	·07
26	·04	·06	·12	·17	·15	·14	·13	·16	·14	·16	·13	·07	·09	·06
27	·08	·03	..	..	..	..	·01	..	..	..	..	..	·01	·02
28	·05	·02	..	·06	·08	·09	·05	·33	·27	·15	·12	·10	·01	..
29	·06	·03	·04	·02	·03	·01	·03	·02	·03	·04	·03	·02	·03	·04
30	·01	·04	·10	·09	·10	·10	·08	·10	·08	·07	·06	·06	·09	·04
*	1·61	1·48	1·37	1·40	1·43	1·24	1·43	1·60	1·42	1·45	1·25	1·29	1·43	1·24
†	7·71	7·34	6·78	6·79	6·72	6·93	6·64	6·46	6·67	6·84	6·32	5·47	7·29	5· 92

* The figures in this row give the totals for the month. † The totals from January 1st.

Note.—The observations are taken at 9 a.m., except at Brixton and Addington Park Farm (8 a.m.), Bromley (8.30 a.m.), South Norwood (8.45 a.m.), and Croydon (Waddon New Road) (10 a.m.).

NOTES.

(April, 1894.)

The first 13 days of the month were, except for the showers on the 1st and 2nd, practically a continuance of fine weather which lasted from 14th March, and after the 13th the weather was mild and showery. Solar halos were seen at Upper Gatton on the 4th, 6th, 7th, 8th, and 25th, those of the 4th and 6th having prismatic colours. The cuckoo was heard on the 8th, a swallow was seen on the 22nd, and bees were swarming on the 29th at Croydon, and at Warlingham the nightingale was heard on the 15th. At Croydon the hawthorn was in flower on the 15th, whilst at Wallington cowslips flowered on the 2nd, the plum on the 3rd, the pear on the 10th, the apple on the 11th, the white chestnut on the 20th, the pink lilac on the 21st, and the white may on the 29th. The mean temperature was at Warlingham 50·5°, at Waddon 50·9°, and at Wallington 51·3°, being about 5° above the mean for April. There were recorded at Woolwich 122 hours of bright sunshine, and at Wallington 162·3 hours of sunlight, which latter was 2 per cent. above the mean.

Francis Campbell Bayard, F.R.Met. Soc.,
Hon. Sec.

CROYDON MICROSCOPICAL AND NATURAL HISTORY CLUB (*Meteorological Subcommittee*).

Stations.	Observers.	Size of Gauge.	Height above Ground.		Height of Statn. ab. Sea-level.
		IN.	FT.	IN.	FT.
Surrey—					
Dorking (Denbies)	J. Beesley	5	0	6	610
Reigate Hill (Margery Hall)	W. F. Taylor	5	2	0	756
Upper Gatton	F. Druce	5	1	0	600
Caterham (Metropol. Asylum)	G. S. Elliott, M.D.	5	1	0	610
Caterham Valley (Congreg. Shl.)	Miss S. W. Rudd	5	1	0	500
Marden Park (Birchwood House)	Mrs. F. Rutley	5	1	0	471
Kent—					
Westerham (The Fishponds)	W. Morris	5	1	0	380
Knockholt (The Beeches)	W. Morris	5	1	0	785
Surrey—					
Warlingham (The Vicarage)	Rev. F. R. Marriott	5	1	0	614
Coulsdon (The Grange)	W. J. Stride	5	1	4	525
Kenley (Ingleside)	H. Smith	8	1	0	375
Purley (Tudor Cottages)	J. Bonwick	5	1	0	216
Ashtead (D'Abernon Chase)	Sir W. Vincent, Bart.	5	1	0	280
Oxshott	W. H. Dines	5	1	0	212
Epsom (Epsom College)	C. J. Gardiner	8	1	0	290
Banstead (The Larches)	Rev. C. J. Taylor	8	1	0	488
Sutton (Mulgrave Road)	W. Goode	5	5	6	230
Wallington (Manor Road)	F. C. Bayard	5	4	1	157
Beddington (Riverside)	S. Rostron	5	1	0	120
Waddon (Waddon House)	P. Crowley	5	1	0	156
Croydon (Brimstone Barn)	Croydon Corporation	5	1	0	130
Croydon (Waddon New Road)	Croydon Corporation	5	1	0	146
Croydon (Duppas House)	Baldwin Latham	8	1	0	158
Croydon (Chatfield Road)	A. Malden	5	1	0	166
Croydon (Whitgift School)	A. E. Watson	5	1	0	191
Croydon (Park Hill Rise)	H. F. Parsons, M.D.	5	1	0	250
Croydon (Outram Road)	E. Mawley	8	0	9	202
Addington Hills (The Reservoir)	Croydon Corporation	8	0	9	473
Addington (Park Farm)	W. Whalley	5	1	0	268
Addington (Pumping Station)	Croydon Corporation	8	1	0	331
Kent—					
West Wickham (Wickham Ct.)	Sir J. F. Lennard, Bart.	5	1	2	300
West Wickham (Layham's Fm.)	W. Ashcroft	5	1	0	500
Hayes Common (The Warren)	Miss Akers	5	1	0	296

Stations.	Observers.	Size of Gauge.	Height above Ground.		Height of Statn. ab. Sea-level.
		IN.	FT.	IN.	FT.
Kent—					
Keston (Bradfield)	A. Hill	5	1	0	350
Keston (Tower Fields)	G. Buchanan	8	0	9	351
Orpington (Kent Water Co.)	W. Morris	5	1	0	220
Farningham Hill	A. J. Waring	5	3	0	300
Wilmington (Kent Water Co.)	W. Morris	5	1	0	25
Bickley (Highfield)	J. Batten	5	1	2	295
Bromley (Sundridge Avenue)	J. B. Snell	5	1	0	245
Bromley Common (Elmfield)	Rev. J. P. Faunthorpe	5	0	9	240
Beckenham (Foxgrove)	P. Bicknell	5	0	6	142
Beckenham (Cedars Road)	H. Dolling Smith	5	1	0	105
Surrey—					
South Norwood (Selhurst Road)	J. Potter	5	1	0	200
Thornton Heath (Thornton Rd.)	A. Wright	8	0	10	120
Wimbledon (Sewage Works)	C. H. Cooper	5	1	0	58
Wimbledon (Mount Ararat)	T. Devas	12	3	0	157
Raynes Park (Pumping Station)	C. H. Cooper	5	1	0	47
New Malden (Sewage Works)	T. V. H. Davison	5	1	0	45
Esher (Sewage Works)	W. H. Hope	5	1	0	40
Surbiton (Seething Wells)	R. Hack	10	0	6	25
Kingston (Sewage Works)	T. Stevens	5	1	0	25
Richmond (Ormond Lodge)	J. T. Billett	5	0	9	51
Wandsworth Com. (Patten Rd.)	F. J. Brodie	5	1	0	100
Streatham Hill (Wavertree Rd.)	F. Jordan	5	0	10	178
West Norwood (Thornlaw Road)	W. Marriott	8	1	0	220
Kent—					
Forest Hill (Dartmouth Road)	Mrs. Behrens	5	1	0	220
Forest Hill (The Nurseries)	James Carter & Co.	6	0	6	76
Forest Hill (S. & V. Water Co.)	J. W. Restler	5	1	0	344
Eltham (High Street)	W. Morris	5	1	0	245
Woolwich (Powis Street)	J. G. Waller	5	30	0	65
Greenwich (Royal Observatory)	Astronomer Royal	8	0	5	155
Deptford (Kent Water Co.)	W. Morris	5	1	0	20
Nunhead (S. & V. Water Co.)	J. W. Restler	5	4	0	176
Surrey—					
Brixton (Acre Lane)	F. Gaster	8	1	0	77
Battersea (S. & V. Water Co.)	J. W. Restler	5	3	0	21

Daily Rainfall. *The 50 years (1841–90) mean at Greenwich for May is 2·01 in.* **May, 1894.**

Day of Mo.	Dorking	Reigate Hill	Upper Gatton	Caterham	Caterham Valley	Marden Park	Westerham	Knockholt	Warling-ham	Coulsdon	Kenley	Purley (Tudor C.)	Ashtead
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	..	..	..	..	..	..		..	..	·01	..	..
2	·11	·10	·10	·07	..	·07	·07		·15	·07	·07	·05	·10
3	..	·02	·01	·01	·04	·04	..		·02	·02	·01	·02	..
4	..	..	..	..	..	·01	..		..	..	·01	..	..
5	..	..	..	..	..	..	..		..	..	..	..	..
6	..	..	..	..	..	..	..		..	..	..	..	..
7	..	..	..	..	..	..	..		..	..	..	..	..
8	..	..	..	..	..	..	..		..	..	..	..	..
9	·15	·11	·13	·11	·08	·07	·21		·10	·11	·12	·09	·10
10	·20	·21	·23	·12	·11	·13	·22		·25	·22	·27	·32	·25
11	·40	·31	·31	·28	·17	·21	·21		·25	·26	·10	·21	·32
12	..	..	·01	..	..	·01	·03		..	..	·14	..	..
13	..	..	..	..	..	..	..		..	..	..	..	..
14	..	..	..	..	..	..	..		..	..	..	..	..
15	·08	·06	·08	·09	..	·07	·10	MONTHLY GAUGE.	·09	·08	·08	·07	·05
16	..	..	..	·01	..	..	..		·02	..	·01	..	·01
17	..	..	..	..	..	..	..		..	..	..	..	..
18	..	..	..	..	..	..	..		..	..	..	..	..
19	..	..	..	..	..	..	..		..	..	..	..	..
20	..	..	..	..	..	..	..		..	..	..	..	·01
21	·02	..	..	..	..	·01	·02		·01	..	..	..	..
22	·04	·07	·08	·07	·04	·02	·05		·12	·08	·07	·08	·04
23	·03	·04	·03	·02	·02	·08	·02		·05	·03	·03	·05	·01
24	..	..	..	..	..	..	..		..	..	..	..	..
25	..	..	..	..	..	..	..		..	..	..	..	..
26	·32	·34	·36	·33	·23	·25	·44		·36	·29	·26	·21	·30
27	·02	·01	..	·01	..	·03	·02		·03	·02	·01	·04	·02
28	·05	·03	·04	·02	·05	·02	·04		·03	·03	·03	·03	·12
29	·32	·28	·30	·14	·18	·10	·47		·17	·17	·19	·17	·13
30	·11	·08	·06	·04	·08	·06	·05		·08	·07	·13	·10	·08
31	·11	·07	·12	·05	·07	·10	·13		·06	·12	·14	·54	·38
*	1·96	1·73	1·86	1·37	1·07	1·28	2·08	2·00	1·79	1·57	1·68	1·98	1·92
†	12·39	11·16	13·36	12·80	11·14	9·51	11·73	10·83	12·59	10·52	11·85	10·77	9·62

Day of Mo.	Oxshott	Epsom	Banstead	Sutton	Wallington	Bedding-ton	Waddon	Croydon (Brim. Bn.)	Croydon (Wn.N.rd.)	Croydon Duppas H.	Croydon Chatfd. rd.	Croydon (Whitgift)	Croydon (Park Hill)
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	..	..	..	..	..	..	..	..	..	..	..	..
2	·10	·09	·07	·07	·05	·05	·05	·06	·05	·06	·05	·05	·06
3	..	..	..	..	·02	·01	·02	..	·01	·01	·01	·02	·01
4	..	..	..	..	..	..	..	..	..	..	..	..	..
5	..	..	..	..	..	..	..	..	..	..	..	..	..
6	..	..	..	..	..	..	..	..	..	..	..	..	..
7	..	..	..	..	..	..	..	..	..	..	..	..	..
8	..	..	..	..	..	..	..	..	..	..	..	..	..
9	·08	·15	·11	·12	·07	·08	·07	·09	·06	·08	·06	·08	·07
10	·24	·22	·22	·25	·21	·20	·20	·21	·20	·20	·20	·20	·20
11	·28	·27	·29	·22	·19	·15	·13	·15	·14	·15	·14	·15	·14
12	..	·01	..	..	..	..	..	..	..	..	..	..	..
13	..	..	..	..	..	..	..	..	..	..	..	..	..
14	..	..	..	..	..	..	..	..	..	..	..	..	..
15	·04	·07	·07	·07	·07	·07	·07	·06	·06	·07	·07	·08	·07
16	·01	..	..	..	..	..	..	..	..	..	..	..	..
17	..	..	..	..	..	..	..	..	..	..	..	..	..
18	..	..	..	..	..	..	..	..	..	..	..	..	..
19	..	..	..	..	..	..	..	..	..	..	..	..	..
20	..	..	..	..	..	..	..	..	..	..	..	..	..
21	..	..	..	..	..	..	..	..	..	..	..	·01	..
22	·03	·04	·05	·03	·04	·04	·04	·05	·04	·05	·06	·06	·04
23	·01	·02	·02	·03	·03	·03	·04	·04	·04	·04	·04	·05	·05
24	..	..	..	..	..	..	..	..	..	..	..	..	..
25	..	..	..	..	..	..	..	..	..	..	..	..	..
26	·28	·29	·30	·28	·28	·29	·26	·26	·24	·25	·27	·27	·26
27	·03	·01	..	..	..	..	·01	·02	..	·01	·02	·02	·01
28	·13	·09	·08	·04	·03	·02	·01	..	·02	·01	·01	·01	..
29	·18	·21	·38	·17	·21	·22	·19	·21	·18	·20	·17	·19	·21
30	·09	·07	·11	·06	·15	·16	·14	·18	·08	·14	·15	·13	·14
31	·08	·12	·11	·08	·12	·12	·11	·15	·17	·10	·14	·12	·12
*	1·58	1·66	1·81	1·42	1·47	1·44	1·34	1·48	1·29	1·37	1·39	1·44	1·38
†	8·57	11·01	11·06	9·49	9·66	8·99	8·26	8·89	8·00	8·88	8·00	8·97	8·85

* The figures in this row give the totals for the month. † The totals from January 1st.

Daily Rainfall. *The 50 years (1841–90) mean at Greenwich for May is 2·01 in.* **May, 1894.**

Day of Mo.	Croydon (Outm. Rd.)	Addington Hills	Addington (Park Fm.)	Addington (Pump. St.)	W. Wickhm Wickhm. C.	W. Wickhm Layhms. F.	Hayes Common	Keston (Bradfield)	Keston (Tow. Fds.)	Orpington	Farningham Hill	Wilmington	Bickley	Bromley	Bromley Common	Beckenham (Foxgrove)	Beckenham (Cedars rd.)	South Norwood	Thornton Heath	Wimbledon (Sew. Wks.)	Wimbledon (Mt. Ararat)	Raynes Park	New Malden	Esher	Surbiton	Kingston
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..
2	·05	·06	·06	·05	·05	·06	·06	..	·07	·06	·06	·07	·05	·06	·06	·06	·05	·06	·06	·06	·08	·09	·06	·04	·06	·07
3	·01	·02	·03	·01	..	..	·02	..	..	·01	·02	..	·01	·02	·02	·02	·02	·02	..	..	..	·02	..	·02	..	..
4	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
7	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
9	·08	·08	·08	·09	·05	·08	·05	·06	·07	·07	·13	·02	·04	·05	·05	·05	·07	·05	·04	·08	·03	·11	·07	·06	..	·09
10	·21	·25	·27	·27	·37	·30	·31	·22	·26	·20	·17	·25	·25	·25	·26	·20	·20	·21	·25	·35	·43	·37	·38	·41	·43	·56
11	·16	·15	·16	·19	·15	·17	·12	·15	·15	·15	·18	·10	·10	·12	·14	·10	·10	·13	·15	·07	·09	·10	·08	·11	·12	·13
12	..	..	·02	..	..	..	..	..	·02	..	..	..	..	·01	·01	..	..	..	..	..	..	..	..	·01	..	..
13	..	..	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·02	..	..	..	..
14	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
15	·07	·08	·06	·05	·08	·08	·08	·08	·09	·12	·12	·12	·09	·09	·10	·08	·07	·09	·07	·09	·07	·07	·05	·03	·04	·05
16	..	..	·01	..	..	..	..	..	..	..	·01	..	..	·01	·01	..	·01	..	..	..	..	·02	..	·01	..	..
17	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
18	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
19	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
20	..	..	..	·01	..	..	..	..	..	..	·01	..	..	..	·02	..	..	..	..	..	..	..	..	..	..	..
21	..	·01	·01	..	..	·02	..	..	..	..	·01	·01	..	..	..	·01	·01	·01	..	..	..	..	..	..	..	·02
22	·05	·07	·09	·08	·10	·08	·07	·12	·10	·12	·12	·07	·10	·08	·09	·07	·06	·05	·06	·02	·02	·02	·01	·02	·02	·01
23	·06	·06	·08	·05	·11	·09	·08	·11	·09	·07	·04	·03	·05	·07	·07	·05	·06	·06	·06	·05	·02	·04	·01	·03	·02	·02
24	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..
25	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
26	·27	·26	·30	·29	·37	·31	·36	·34	·37	·33	·30	·21	·34	·31	·32	·31	·31	·26	·28	·27	·31	·32	·24	·24	·26	·30
27	·01	·02	·03	·02	·01	·02	·02	·01	·02	·01	..	..	·03	·03	·03	·02	·03	·02	..	·01	..	·03	..	·03	..	..
28	·01	·02	·01	·02	..	·01	·01	·02	..	..	..	..	..	..	..	·01	·01	·01	..	·05	·08	·11	·06	·07	·09	·05
29	·18	·17	·13	·18	·15	·14	·12	·10	·12	·08	·27	..	·05	·06	·10	·15	·13	·10	·09	·23	·16	·33	·15	·21	·13	·16
30	·15	·08	·12	·08	·08	·03	·07	·08	·07	·07	·04	·15	·06	·06	·10	·08	·09	·05	·08	·15	·09	·08	·11	·12	·15	·25
31	·13	·28	·28	·16	·19	·13	·18	·12	·18	·18	·20	·15	·15	·22	·21	·12	·09	·03	·10	·29	·14	·18	·19	·13	·17	·12
*	1·44	1·61	1·74	1·55	1·71	1·52	1·56	1·41	1·61	1·47	1·68	1·18	1·32	1·45	1·59	1·33	1·31	1·25	1·24	1·72	1·57	1·91	1·41	1·55	1·49	1·83
†	8·89	9·56	10·76	10·39	11·15	11·03	9·42	8·75	10·32	9·30	9·24	6·53	8·29	8·61	8·88	8·02	8·15	8·15	8·21	8·53	8·84	10·24	7·16	8·58	8·81	10·02

* The figures in this row give the totals for the month. † The totals from January 1st.

Daily Rainfall. *50 years (1841-90) mean for Greenwich for May is 2·01 in.* **May, 1894.**

Day of Mo.	Richmond	Wandswth. Common	Streatham Hill	West Norwood	Forest Hill Dartmh.rd.	Forest Hill (Nurseries)	Forest Hill S.&V.W.C.	Eltham	Woolwich	Greenwich	Deptford	Nunhead	Brixton	Battersea
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	·01	·01	..	..	..	..	..	..	..	..	..	..	..
2	·07	·05	·04	·06	·06	·04	·06	·05	·04	·05	·04	·03	·04	·03
3	..	..	·02	·01	..	·02	·02	·01	·02	·03	·01	..	·01	..
4	..	..	..	..	..	·01	..	..	..	..	..	..	..	..
5	..	..	..	..	..	..	..	..	..	..	..	..	..	..
6	..	..	..	..	..	..	..	..	..	..	..	..	..	..
7	..	..	..	..	·01	..	..	..	..	..	..	..	..	..
8	..	..	..	..	..	..	..	..	..	..	..	..	..	..
9	·08	·08	·08	·07	·08	·05	·07	·03	·06	·07	·05	·04	·13	·09
10	·57	·26	·35	·33	·36	·31	·32	·23	·33	·31	·31	·32	·40	·25
11	·15	·08	·07	·07	·06	·05	·05	·05	·06	·06	·04	·05	·08	·10
12	..	·01	·01	..	..	..	..	..	..	..	..	..	..	..
13	..	·01	·01	·01	..	..	..	..	..	..	..	..	..	..
14	..	..	..	..	..	..	..	..	..	..	..	..	..	..
15	·05	·08	·08	·07	·09	·09	·08	·10	·10	·09	·07	·07	·07	·05
16	..	·01	·01	..	·01	..	·01	·01	·01	..	..	..	..	·01
17	..	..	..	..	..	..	..	..	..	..	..	..	..	..
18	..	..	..	..	..	..	..	..	..	..	..	..	..	..
19	..	..	..	..	..	..	..	..	..	..	..	..	..	..
20	..	..	..	..	..	..	..	..	..	..	..	..	..	..
21	..	·02	..	..	·02	..	·01	..	·01	·04	·02	..	..	..
22	·01	·02	·03	·05	·08	..	·07	·07	·04	·04	·02	·02	·04	·01
23	·02	·05	·06	·04	·07	·14	·05	·09	·23	·10	·09	·07	·06	·03
24	..	..	·01	..	..	..	..	..	..	..	..	..	..	..
25	..	..	..	..	..	..	..	..	·01	..	..	..	..	..
26	·27	·24	·29	·30	·26	·32	·25	·30	·27	·31	·30	·21	·31	·29
27	·01	·01	..	·01	·03	·03	·03	·01	..	·02	·02	·02	..	·01
28	·06	·01	..	·01	·01	..	·01	..	..	·01	..	·01	..	·03
29	·20	·16	·20	·12	·07	..	·08	·08	·06	·07	·08	·11	·15	·12
30	·14	·10	·18	·15	·10	·16	·16	·12	·15	·18	·14	·11	·19	·13
31	·16	·27	·13	·16	·11	·11	·15	·10	·14	·14	·13	·17	·49	·17
*	1·79	1·47	1·58	1·46	1·42	1·33	1·42	1·25	1·53	1·52	1·32	1·23	1·97	1·32
†	9·50	8·81	8·36	8·25	8·14	8·26	8·06	7·71	8·20	8·36	7·64	6·70	9·26	7·24

* The figures in this row give the totals for the month. † The totals from January 1st,

Note.—The observations are taken at 9 a.m., except at Brixton and Addington Park Farm (8 a.m.), Bromley (8.30 a.m.), South Norwood (8.45 a.m.), and Croydon (Waddon New Road) (10 a.m.).

NOTES.

(May, 1894.)

The month was a very variable one, the first half being comparatively warm, and the latter half being very cold with a northerly wind. The frosts on the 20th to the 22nd, though not very severe, did immense damage to all young growth, destroying in most places throughout the district potatoes, strawberries, gooseberries, most young vegetables, and the young shoots of the oak, ash, and ivy. The hay crop looks exceedingly well. Solar halos were seen at Upper Gatton on the 15th and 25th, and a lunar one on the 14th, and a lunar corona on the 18th. The mean temperature was at Warlingham 49·5°, at Waddon 50·6°, and at Wallington 50·7°, being about 2° below the mean for May. There were recorded at Woolwich 149 hours of bright sunshine, and at Wallington 163·4 hours of sunlight, which latter was 9 per cent. above the mean for May.

FRANCIS CAMPBELL BAYARD, F.R.Met. Soc.,
Hon. Sec.

CROYDON MICROSCOPICAL AND NATURAL HISTORY CLUB *(Meteorological Subcommittee).*

Stations.	Observers.	Size of Gauge.	Height above Ground.		Height of Statn. ab. Sea-level.
		IN.	FT.	IN.	FT.
SURREY—					
Dorking (Denbies)	J. Beesley	5	0	6	610
Reigate Hill (Margery Hall)	W. F. Taylor	5	2	0	756
Upper Gatton	F. Druce	5	1	0	600
Caterham (Metropol. Asylum)	G. S. Elliott, M.D.	5	1	0	610
Caterham Valley (Congreg. Shl.)	Miss S. W. Rudd	5	1	0	500
Marden Park (Birchwood House)	Mrs. F. Rutley	5	1	0	471
KENT—					
Westerham (The Fishponds)	W. Morris	5	1	0	380
Knockholt (The Beeches)	W. Morris	5	1	0	785
SURREY—					
Warlingham (The Vicarage)	Rev. F. R. Marriott	5	1	0	614
Coulsdon (The Grange)	W. J. Stride	5	1	4	525
Kenley (Ingleside)	H. Smith	8	1	0	375
Purley (Tudor Cottages)	J. Bonwick	5	1	0	216
Ashtead (D'Abernon Chase)	Sir W. Vincent, Bart.	5	1	0	280
Oxshott	W. H. Dines	5	1	0	212
Epsom (Epsom College)	C. J. Gardiner	8	1	0	290
Banstead (The Larches)	Rev. C. J. Taylor	8	1	0	488
Sutton (Mulgrave Road)	W. Goode	5	5	6	230
Wallington (Maldon Road)	F. C. Bayard	5	4	1	140
Beddington (Riverside)	S. Rostron	5	1	0	120
Waddon (Waddon House)	P. Crowley	5	1	0	156
Croydon (Brimstone Barn)	Croydon Corporation	5	1	0	130
Croydon (Waddon New Road)	Croydon Corporation	5	1	0	146
Croydon (Duppas House)	Baldwin Latham	8	1	0	158
Croydon (Chatfield Road)	A. Malden	5	1	0	166
Croydon (Whitgift School)	A. E. Watson	5	1	0	191
Croydon (Park Hill Rise)	H. F. Parsons, M.D.	5	1	0	250
Croydon (Outram Road)	E. Mawley	8	0	9	202
Addington Hills (The Reservoir)	Croydon Corporation	8	0	9	473
Addington (Park Farm)	W. Whalley	5	1	0	268
Addington (Pumping Station)	Croydon Corporation	8	1	0	331
KENT—					
West Wickham (Wickham Ct.)	Sir J. F. Lennard, Bart.	5	1	2	300
West Wickham (Layham's Fm.)	W. Ashcroft	5	1	0	500
Hayes Common (The Warren)	Miss Akers	5	1	0	296

Stations.	Observers.	Size of Gauge.	Height above Ground.		Height of Statn. ab. Sea-level.
		IN.	FT.	IN.	FT.
KENT—					
Keston (Bradfield)	A. Hill	5	1	0	350
Keston (Tower Fields)	G. Buchanan	8	0	9	351
Orpington (Kent Water Co.)	W. Morris	5	1	0	220
Farningham Hill	A. J. Waring	5	3	0	300
Wilmington (Kent Water Co.)	W. Morris	5	1	0	25
Bickley (Highfield)	J. Batten	5	1	2	295
Bromley (Sundridge Avenue)	J. B. Snell	5	1	0	245
Bromley Common (Elmfield)	Rev. J. P. Faunthorpe	5	0	9	240
Beckenham (Foxgrove)	P. Bicknell	5	0	6	142
Beckenham (Cedars Road)	H. Dolling Smith	5	1	0	105
SURREY—					
South Norwood (Selhurst Road)	J. Potter	5	1	0	200
Thornton Heath (Thornton Rd.)	A. Wright	8	0	10	120
Wimbledon (Sewage Works)	C. H. Cooper	5	1	0	58
Wimbledon (Mount Ararat)	T. Devas	12	3	0	157
Raynes Park (Pumping Station)	C. H. Cooper	5	1	0	47
New Malden (Sewage Works)	T. V. H. Davison	5	1	0	45
Esher (Sewage Works)	W. H. Hope	5	1	0	40
Surbiton (Seething Wells)	R. Hack	10	0	6	25
Kingston (Sewage Works)	T. Stevens	5	1	0	25
Richmond (Ormond Lodge)	J. T. Billett	5	0	9	51
Wandsworth Com. (Patten Rd.)	F. J. Brodie	5	1	0	100
Streatham (Woodfield Avenue)	F. Jordan	5	1	0	120
West Norwood (Thornlaw Road)	W. Marriott	8	1	0	220
KENT—					
Forest Hill (Dartmouth Road)	Mrs. Behrens	5	1	0	220
Forest Hill (The Nurseries)	James Carter & Co.	6	0	6	76
Forest Hill (S. & V. Water Co.)	J. W. Restler	5	1	0	344
Eltham (High Street)	W. Morris	5	1	0	245
Woolwich (Powis Street)	J. G. Waller	5	30	0	65
Greenwich (Royal Observatory)	Astronomer Royal	8	0	5	155
Deptford (Kent Water Co.)	W. Morris	5	1	0	20
Nunhead (S. & V. Water Co.)	J. W. Restler	5	4	0	176
SURREY—					
Brixton (Acre Lane)	F. Gaster	8	1	0	77
Battersea (S. & V. Water Co.)	J. W. Restler	5	3	0	21

Day of Mo.	Dorking	Reigate Hill	Upper Gatton	Caterham	Caterham Valley	Marden Park	Westerham	Knockholt	Warling-ham	Coulsdon	Kenley	Purley (Tudor C.)	Ashtead	Oxshott	Epsom	Banstead	Sutton	Wallington	Bedding-ton	Waddon	Croydon (Brim. Bn.)	Croydon (Wn.N.rd.)	Croydon Duppas H.	Croydon Chatfd. rd.	Croydon (Whitgift)	Croydon (Park Hill)
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·25	·24	·24	·21	·13	·10	·17		·18	·15	·17	·17	·10	·16	·12	·15	·14	·16	·16	·13	·15	·13	·15	·14	·15	·13
2	..	·01	·01	..	..	..	..		..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	·01
3	·40	·44	·41	·33	·28	·44	·41		·43	·26	·32	·33	·41	·36	·42	·36	·37	·30	·29	·26	·25	·32	·28	·27	·29	·26
4	·20	·28	·31	·18	·10	·08	·15		·16	·32	·29	·22	·10	·10	·22	·21	·21	·23	·22	·20	·20	·12	·19	·22	·21	·22
5	..	..	..	·01	..	..	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
6	·70	·72	·77	·63	·42	·57	·70		·68	·66	·62	·82	·75	·71	·71	·72	·72	·70	·72	·67	·68	·64	·68	·68	·70	·67
7	..	..	..	..	..	..	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
8	·07	·08	·08	·05	·10	·05	·09		·09	·07	·09	·08	·06	·04	·05	·05	·09	·08	·09	·08	·09	·08	·09	·07	·08	·09
9	..	·02	·02	·03	·04	·01	·01		·01	..	..	·03	..	..	..	..	..	..	..	·01	..	..	..	..	..	..
10	·08	·08	·08	·05	·02	·03	·16		·02	·02	·12	·01	..	·01	·01	..	·03	·03	·04	·04	·04	·04	·05	·05	·04	·04
11	·11	·06	·10	·05	·07	·10	·11		·27	·11	·18	·19	·02	·01	·02	·03	·15	·19	·20	·18	·21	·20	·20	·16	·25	·18
12	..	·28	·13	·25	·21	·31	·32		·30	·21	·25	·23	·06	·04	·16	·18	·19	·24	·29	·31	·33	·28	·28	·32	·33	·36
13	..	..	..	..	..	..	..		..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
14	..	..	..	..	..	..	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
15	·21	·19	·16	·15	·15	·14	·17	MONTHLY GAUGE.	·16	·14	·15	·19	·10	·15	·18	·16	·16	·16	·17	·18	·18	·16	·17	·17	·17	·18
16	..	..	..	..	..	·01	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
17	..	·06	·01	..	..	·01	..		·02	..	·01	..	..	·01	..	·01	·01	..	..	·01	·02	·01	·01	..	·01	..
18	·28	·09	·25	·20	·15	·18	·15		·20	·22	·19	·20	·20	·21	·19	·22	·20	·19	·21	·10	·22	·20	·20	·23	·23	·23
19	..	..	·01	·01	·02	..	·01		..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..
20	·29	·33	·27	·26	·23	·23	·28		·24	·24	·22	·18	·25	·24	·24	·25	·21	·19	·18	·18	·20	·16	·18	·18	·19	·18
21	..	·01	..	..	..	..	..		·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
22	..	..	..	..	..	..	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
23	..	·01	·02	..	..	..	..		·03	·02	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
24	..	..	..	..	..	..	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
25	..	..	·01	..	..	·01	..		..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..
26	..	..	..	..	..	..	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
27	..	..	..	..	..	..	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
28	..	..	..	..	..	..	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
29	..	..	..	..	..	..	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
30	..	..	..	..	..	..	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
*	2·59	2·90	2·88	2·41	1·92	2·36	2·73	1·75	2·80	2·42	2·62	2·65	2·07	2·04	2·32	2·34	2·48	2·47	2·57	2·35	2·58	2·34	2·48	2·49	2·65	2·55
†	14·98	14·06	16·24	15·21	13·06	11·87	14·46	12·58	15·39	12·94	14·47	13·42	11·69	10·61	13·33	13·40	11·97	12·13	11·56	10·61	11·47	10·34	11·36	10·49	11·62	11·40

* The figures in this row give the totals for the month. † The totals from January 1st.

Daily Rainfall. *The 50 years (1841–90) mean at Greenwich for June is 2·02 in.* **June, 1894.**

Day of Mo.	Croydon (Outm.Rd.)	Addington Hills	Addington (Park Fm.)	Addington (Pump.St.)	W.Wickhm Wickhm.C.	W.Wickhm Layhms. F.	Hayes Common	Keston (Bradfield)	Keston (Tow. Fds.)	Orpington	Farning-ham Hill	Wilming-ton	Bickley	Bromley	Bromley Common	Beckenham (Foxgrove)	Beckenham (Cedarsrd.)	South Norwood	Thornton Heath	Wimbledon (Sew. Wks.)	Wimbledon (Mt.Ararat)	Raynes Park	New Malden	Esher	Surbiton	Kingston
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·13	·14	·15	·15	·12	·08	·11	·07	·08	·10	·15	·10	·13	·16	·11	·16	·14	·14	·13	·16	·17	·19	·14	·17	·17	·22
2	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	·01	..	..	..	..	..	..	·01	..	·01	..	..
3	·27	·28	·23	·29	·30	·36	·24	·28	·21	·38	·22	·26	·27	·25	·27	·24	·23	·24	·25	·40	·45	·48	·41	·39	·43	·52
4	·20	·30	·38	·30	·32	·20	·29	·27	·38	·15	·22	·15	·32	·33	·30	·24	·25	·23	·26	·14	·13	·15	·08	·06	·04	·02
5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	..	..	..	·01	..	..
6	·69	·70	·70	·69	·82	·73	·70	·72	·74	·72	·66	·52	·77	·70	·58	·69	·70	·69	·66	·63	·71	·68	·63	·44	·63	·67
7	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	..	..	·01	..	..	..	..
8	·07	·09	·14	·08	·08	·08	·07	·06	·06	·04	·04	·04	·04	·05	·05	·05	·05	·06	·08	·12	·11	·11	·07	·08	..	·10
9	..	·01	·02	·01	..	..	..	..	..	..	·02	·01	..	..	·01	..	..	..	..	..	·01	·02	·01	·02	..	..
10	·03	·02	·03	·01	·05	..	·05	·02	·04	·05	·09	·02	·04	·04	·05	·02	·04	·08	·07	·03	·02	·03	·04	·07	·05	·04
11	·14	·22	·24	·17	·11	·19	·09	·09	·10	·10	·06	·07	·15	·18	·12	·15	·12	·11	·07	·14	·08	·12	·17	..	·06	·19
12	·31	·39	·35	·52	·37	·33	·14	·16	·11	·09	·13	·06	·08	·09	·10	·08	·10	·19	·28	·14	·27	·23	·05	·02	·07	·03
13	..	..	..	..	..	..	..	·01	·01	·03	·02	..	..	·01	·02	..	..	..	..	..	..	..	..	..	..	..
14	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
15	·17	·19	·19	·17	·20	·16	·18	·18	·18	·19	·16	·13	·16	·16	·16	·16	·16	·17	·18	·17	·17	·18	·16	·15	·16	·18
16	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..
17	·02	..	·01	·01	..	·02	..	·01	..	..	·02	..	..	..	·01	·01	·01	..	..	..	·01	·03	·01	·02	·01	·02
18	·22	·19	·17	·18	·21	·18	·18	·15	·17	·15	·18	·18	·21	·19	·22	·18	·19	·23	·22	·19	·20	·22	·16	·13	·16	·16
19	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	·01	..	..	..	..	..	..	..	..	·02	..	..
20	·18	·18	·18	·18	·20	·18	·18	·14	·18	·17	·21	·15	·23	·24	·18	·25	·24	·18	·18	·30	·24	·23	·21	·20	·22	·15
21	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
22	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
23	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·02	..	..	..	..	..	..	..	..	..	..	..
24	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
25	..	·02	·01	·02	..	·02	..	·02	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
26	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
27	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
28	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
29	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
30	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
*	2·43	2·73	2·80	2·78	2·78	2·53	2·23	2·18	2·27	2·18	2·18	1·69	2·40	2·43	2·23	2·23	2·23	2·32	2·38	2·42	2·57	2·69	2·14	1·79	2·00	2·30
†	11·32	12·29	13·56	13·17	13·93	13·56	11·65	10·93	12·59	11·48	11·42	8·22	10·69	11·04	11·11	10·25	10·38	10·47	10·59	10·95	11·41	12·93	9·30	10·37	10·81	12·32

* The figures in this row give the totals for the month. † The totals from January 1st.

Daily Rainfall. *50 years (1841·90) mean for Greenwich for June is 2·02 in.* **June, 1894.**

Day of Mo.	Richmond	Wandswth. Common	Streatham	West Norwood	Forest Hill Dartmh.rd.	Forest Hill (Nurseries)	Forest Hill S.&V.W.C.	Eltham	Woolwich	Greenwich	Deptford	Nunhead	Brixton	Battersea
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·18	·17	·15	·14	·15	·16	·15	·14	·16	·18	·15	·12	·16	·14
2	..	·01	..	..	..	..	·01	..	..	..	..	..	..	..
3	·46	·46	·43	·31	·30	·17	·24	·27	·30	·26	·21	·34	·35	·45
4	·04	·13	·21	·22	·27	·31	·24	·30	·23	·23	·24	·18	·21	·06
5	..	..	..	..	..	..	..	..	..	..	..	..	..	..
6	·53	·50	·54	·58	·59	·60	·55	·54	·56	·51	·52	·54	·49	·40
7	..	..	..	..	..	..	..	..	..	..	..	..	..	..
8	·09	·08	·11	·09	·10	·09	·10	·09	·07	·08	·06	·07	·08	·07
9	..	..	·01	·01	..	..	·01	·01	..	..	..	..	..	..
10	·06	·07	·02	·02	·03	·02	·02	·02	·04	·09	·08	·03	·10	·03
11	·12	·12	·10	·11	·13	·10	·10	·15	·07	·19	·19	·09	·12	·07
12	·15	·13	·15	·21	·10	·08	·09	·07	·07	·03	·04	·06	·17	·06
13	..	..	..	..	..	..	·01	·03	·02	..	..	..	..	..
14	..	..	..	..	..	..	..	..	..	..	..	..	..	..
15	·17	·12	·15	·15	·15	·17	·15	·15	·14	·14	·13	·11	·14	·14
16	..	..	..	..	..	..	..	..	..	..	..	..	..	..
17	·03	·02	..	·01	·01	..	·01	·01	·01	·01	..	..	·01	·01
18	·11	·14	·22	·26	·26	·26	·21	·17	·12	·11	·08	·10	·14	·07
19	..	..	·01	..	..	..	..	..	..	..	..	..	..	..
20	·23	·19	·28	·26	·21	·25	·23	·19	·20	·21	·21	·19	·23	·18
21	..	..	·01	..	..	..	..	..	..	..	..	..	..	..
22	..	..	..	..	..	..	..	..	..	..	..	..	..	..
23	..	..	..	..	..	..	..	..	..	..	..	..	..	..
24	..	..	..	..	..	..	..	..	..	..	..	..	..	..
25	..	..	..	..	..	..	..	..	..	..	..	..	..	..
26	..	..	..	..	..	..	..	..	..	..	..	..	..	..
27	..	..	..	..	..	..	..	..	..	..	..	..	..	..
28	..	..	..	..	..	..	..	..	..	..	..	..	..	..
29	..	..	..	..	..	..	..	..	..	..	..	..	..	..
30	..	..	..	..	..	..	..	..	..	..	..	..	..	..
*	2·17	2·14	2·39	2·37	2·30	2·21	2·12	2·14	1·99	2·04	1·91	1·83	2·20	1·68
†	11·67	10·95	....	10·62	10·44	10·47	10·18	9·85	10·19	10·40	9·55	8·53	11·46	8·92

* The figures in this row give the totals for the month. † The totals from January 1st.

Note.—The observations are taken at 9 a.m., except at Brixton and Addington Park Farm (8 a.m.), Bromley (8.30 a.m.), South Norwood (8.45 a.m.), and Croydon (Waddon New Road) (10 a.m.).

NOTES.

(June, 1894.)

The month may be divided into two portions, *viz.*, from 1–20 wet and cool, and 21–30 fine and warm. The general result of these two periods is that, so far as Wallington is concerned, it is the coolest June, with the exception of June, 1886, in the record commencing in 1884; and with the exception of June, 1892, the wettest in the Wallington rain record commencing in 1882. The fine period at the end of the month has been most favourable for the hay crop, which has been got in in splendid condition. Flowers have been very abundant, but the fruit prospects vary very greatly, some portions of the district having little or none. Solar halos were seen at Upper Gatton on the 16th and 24th, and at Croydon on the 16th. The mean temperature of the month was at Wallington 58·2°, at Warlingham 58·5°, and at Waddon 58·8°, being about 0·5° below the average. There were recorded at Woolwich 136 hours of bright sunshine, and at Wallington 170·2 hours of sunlight, which latter is 8 per cent. below the mean for June.

FRANCIS CAMPBELL BAYARD, F.R.Met.Soc.,
Hon. Sec.

CROYDON MICROSCOPICAL AND NATURAL HISTORY CLUB (*Meteorological Subcommittee*).

Stations.	Observers.	Size of Gauge.	Height above Ground.		Height of Statn. ab. Sea-level.
		IN.	FT.	IN.	FT.
Surrey—					
Dorking (Denbies)	J. Beesley	5	0	6	610
Reigate Hill (Margery Hall)	W. F. Taylor	5	2	0	756
Upper Gatton	F. Druce	5	1	0	600
Caterham (Metropol. Asylum)	G. S. Elliott, M.D.	5	1	0	610
Caterham Valley (Congreg. Shl.)	Miss S. W. Rudd	5	1	0	500
Marden Park (Birchwood House)	Mrs. F. Rutley	5	1	0	471
Kent—					
Westerham (The Fishponds)	W. Morris	5	1	0	380
Knockholt (The Beeches)	W. Morris	5	1	0	785
Surrey—					
Warlingham (The Vicarage)	Rev. F. R. Marriott	5	1	0	614
Coulsdon (The Grange)	W. J. Stride	5	1	4	525
Kenley (Ingleside)	H. Smith	8	1	0	375
Purley (Tudor Cottages)	J. Bonwick	5	1	0	216
Ashtead (D'Abernon Chase)	Sir W. Vincent, Bart.	5	1	0	280
Oxshott	W. H. Dines	5	1	0	212
Epsom (Epsom College)	C. J. Gardiner	8	1	0	290
Banstead (The Larches)	Rev. C. J. Taylor	8	1	0	488
Sutton (Mulgrave Road)	W. Goode	5	5	6	230
Wallington (Maldon Road)	F. C. Bayard	5	4	1	140
Beddington (Riverside)	S. Rostron	5	1	0	120
Waddon (Waddon House)	P. Crowley	5	1	0	156
Croydon (Brimstone Barn)	Croydon Corporation	5	1	0	130
Croydon (Waddon New Road)	Croydon Corporation	5	1	0	146
Croydon (Duppas House)	Baldwin Latham	8	1	0	158
Croydon (Chatfield Road)	A. Malden	5	1	0	166
Croydon (Whitgift School)	A. E. Watson	5	1	0	191
Croydon (Park Hill Rise)	H. F. Parsons, M.D.	5	1	0	250
Croydon (Outram Road)	E. Mawley	8	0	9	202
Addington Hills (The Reservoir)	Croydon Corporation	8	0	9	473
Addington (Park Farm)	W. Whalley	5	1	0	268
Addington (Pumping Station)	Croydon Corporation	8	1	0	331
Kent—					
West Wickham (Wickham Ct.)	Sir J. F. Lennard, Bart.	5	1	2	300
West Wickham (Layham's Fm.)	W. Ashcroft	5	1	0	500
Hayes Common (The Warren)	Miss Akers	5	1	0	296
Kent—					
Keston (Bradfield)	A. Hill	5	1	0	350
Keston (Tower Fields)	G. Buchanan	8	0	9	351
Orpington (Kent Water Co.)	W. Morris	5	1	0	220
Farningham Hill	A. J. Waring	5	3	0	300
Wilmington (Kent Water Co.)	W. Morris	5	1	0	25
Bickley (Highfield)	J. Batten	5	1	2	295
Bromley (Sundridge Avenue)	J. B. Snell	5	1	0	245
Bromley Common (Elmfield)	Rev. J. P. Faunthorpe	5	0	9	240
Beckenham (Foxgrove)	P. Bicknell	5	0	6	142
Beckenham (Cedars Road)	H. Dolling Smith	5	1	0	105
Surrey—					
South Norwood (Selhurst Road)	J. Potter	5	1	0	200
Thornton Heath (Thornton Rd.)	A. Wright	8	0	10	120
Wimbledon (Sewage Works)	C. H. Cooper	5	1	0	58
Wimbledon (Mount Ararat)	T. Devas	12	3	0	157
Raynes Park (Pumping Station)	C. H. Cooper	5	1	0	47
New Malden (Sewage Works)	T. V. H. Davison	5	1	0	45
Esher (Sewage Works)	W. H. Hope	5	1	0	40
Surbiton (Seething Wells)	R. Hack	10	0	6	25
Kingston (Sewage Works)	T. Stevens	5	1	0	25
Richmond (Ormond Lodge)	J. T. Billett	5	0	9	51
Wandsworth Com. (Patten Rd.)	F. J. Brodie	5	1	0	100
Streatham (Woodfield Avenue)	F. Jordan	5	1	0	120
West Norwood (Thornlaw Road)	W. Marriott	8	1	0	220
Kent—					
Forest Hill (Dartmouth Road)	Mrs. Behrens	5	1	0	220
Forest Hill (The Nurseries)	James Carter & Co.	6	0	6	76
Forest Hill (S. & V. Water Co.)	J. W. Restler	5	1	0	344
Eltham (High Street)	W. Morris	5	1	0	245
Woolwich (Powis Street)	J. G. Waller	5	30	0	65
Greenwich (Royal Observatory)	Astronomer Royal	8	0	5	155
Deptford (Kent Water Co.)	W. Morris	5	1	0	20
Nunhead (S. & V. Water Co.)	J. W. Restler	5	4	0	176
Surrey—					
Brixton (Acre Lane)	F. Gaster	8	1	0	77
Battersea (S. & V. Water Co.)	J. W. Restler	5	3	0	21

Daily Rainfall.

The 50 years (1841–90) mean at Greenwich for July is 2·48 in.

July, 1894.

Day of Mo.	Dorking	Reigate Hill	Upper Gatton	Caterham	Caterham Valley	Marden Park	Westerham	Knockholt	Warling-ham	Coulsdon	Kenley	Purley (Tudor C.)	Ashtead	Oxshott	Epsom	Banstead	Sutton	Wallington	Bedding-ton	Waddon	Croydon (Brim. Bn.)	Croydon (Wn.N.rd.)	Croydon Duppas H.	Croydon Chatfd. rd.	Croydon (Whitgift)	Croydon (Park Hill)
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	·02	..	..	..	..	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
2	·07	..	·01	·05	·08	·07	·05		·05	..	..	..	·07	·07	..	..	·05	..	..	..	..	..	..	..	..	..
3	..	..	..	..	..	..	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
4	..	..	..	..	..	..	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
5	..	..	..	..	..	..	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
6	·06	·22	·23	·20	·21	·19	·37		·20	·19	·20	·15	·07	·04	·14	·16	·16	·16	·17	·16	·15	·16	·18	·15	·18	·20
7	..	..	..	..	..	..	..		..	..	·03	·12	..	·01	..	..	..	..	..	..	..	..	..	..	..	..
8	·41	·59	·56	·57	·55	·50	·06		·44	·49	·34	·20	·21	·22	·21	·26	·18	·18	·18	·19	·19	·18	·20	·17	·20	·18
9	·11	·09	·09	·12	·15	·27	·02		·14	·09	·15	·05	·09	·10	·13	·06	·14	·10	·10	·10	·09	·09	·10	·08	·10	·11
10	1·43	1·39	1·49	1·55	1·00	1·17	1·35		1·84	1·67	1·70	2·03	1·45	1·25	1·46	1·67	1·61	1·80	1·80	1·85	1·82	1·73	1·85	1·89	1·87	1·77
11	·23	·34	·30	·34	·17	·11	·26		·12	·41	·46	·36	·21	·17	·16	·11	·12	·17	·20	·32	·29	·30	·31	·28	·31	·51
12	·05	·09	·10	·14	·15	·12	·17		·24	·28	·33	·18	·08	·10	·09	·17	·16	·21	·18	·20	·20	·16	·22	·17	·23	·22
13	·40	·08	·08	·02	·09	·05	..		·02	·07	·05	·09	·13	·17	·26	·02	·15	·03	·03	·03	·06	·04	·05	·04	·04	·02
14	·15	·02	·11	..	·03	·06	·36		·10	..	·03	·03	·03	·13	·02	..	·03	..	·03	·04	·08	·06	·06	·11	·05	·03
15	·03	..	·02	·10	..	·08	·03		·05	·06	·02	..	·09	·05	·03	·04	·04	·03	·03	·03	·04	·01	·03	·03	·04	·03
16	·08	·10	·08	·11	·10	·07	·13	MONTHLY GAUGE.	·10	·08	·10	·06	·03	·08	·06	·07	·11	·09	·10	·08	·10	·09	·09	·15	·08	·08
17	·06	·04	·05	·03	·05	·04	·09		·08	·04	·03	·04	·01	·02	·02	·04	·05	·05	·05	·04	·06	·05	·05	·07	·07	·06
18	..	·01	·01	..	..	·01	·03		..	..	·01	·02	·03	·01	·01	..	..	..	..	·01	·02	·01	·01	·01	·01	·01
19	·15	·26	·06	..	·07	·01	..		·04	·02	·01	..	·18	·02	·02	·01	·03	·01	·07	·07	·08	·06	·06	·05	·07	·06
20	·24	·28	·27	·27	·20	·17	·25		·24	·17	·19	·23	·02	·18	·16	·20	·18	·17	·17	·17	·15	·18	·19	·16	·19	·20
21	..	·28	·14	·15	·23	·11	..		·09	·03	·01	·03	·10	·03	·04	·02	·03	·06	·07	·08	·08	·06	·06	·06	·07	·05
22	·10	..	·10	·09	..	·10	·30		·12	·06	·07	..	·02	·08	·03	·03	·04	·08	·10	·09	·11	·09	·08	·09	·10	·20
23	·03	..	·04	·05	..	·05	·09		·06	·04	·04	·04	·13	·02	·03	·03	·04	·03	·03	·03	·04	·03	·03	·03	·04	·04
24	·11	·17	·14	·10	·10	·12	·07		·11	·07	·10	·17	·02	·12	·14	·10	·10	·10	·12	·09	·10	·10	·09	·06	·07	·06
25	..	·02	·03	·02	..	·03	·02		·03	·02	·03	..	·02	·02	..	..	·02	·01	..	·01	·02	·01	·01	..	..	..
26	·21	..	·01	..	..	..	·01		..	..	..	..	..	..	·05	..	..	..	..	..	..	..	..	..	..	..
27	..	..	..	..	..	..	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	..
28	..	..	..	..	..	..	..		..	..	..	..	·03	·15	..	..	..	..	..	..	..	..	..	..	..	..
29	·80	·60	·63	·84	·70	·66	·44		·63	·66	·60	·46	·71	·70	·62	·68	·37	·37	·18	·15	·18	·16	·16	·24	·24	·25
30	..	..	..	·01	..	..	..		..	..	..	·03	..	..	..	..	..	..	..	·01	..	·01	..	..	..	..
31	..	..	..	..	·09	..	·02		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
*	4·72	4·60	4·55	4·76	3·97	3·99	4·12	4·50	4·70	4·45	4·50	4·29	3·73	3·74	3·68	3·67	3·61	3·65	3·61	3·75	3·86	3·58	3·84	3·84	3·96	4·08
†	19·70	18·66	20·79	19·97	17·03	15·86	18·58	17·08	20·09	17·39	18·97	17·71	15·42	14·35	17·01	17·07	15·58	15·78	15·17	14·36	15·33	13·92	15·20	14·33	15·58	15·48

* The figures in this row give the totals for the month. † The totals from January 1st.

Daily Rainfall. *The 50 years (1841–90) mean at Greenwich for July is 2·48 in.* **July, 1894.**

Day of Mo.	Croydon (Outm.Rd.)	Addington Hills	Addington (Park Fm.)	Addington (Pump. St.)	W. Wickhm Wickhm. C.	W. Wickhm Layhms. F.	Hayes Common	Keston (Bradfield)	Keston (Tow. Fds.)	Orpington	Farningham Hill	Wilmington	Bickley
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	··	··	··	··	··	··	··	··	··	··	··	··	··
2	··	··	··	··	··	··	··	··	··	··	··	··	··
3	··	··	··	··	··	··	··	··	··	··	··	··	··
4	··	··	··	··	··	··	··	··	··	··	··	··	··
5	··	··	··	··	··	··	··	··	··	··	··	··	··
6	·19	·19	·21	·19	·20	·21	·18	·20	·21	·18	·27	·16	·16
7	··	··	··	·01	··	·04	··	··	··	·02	··	··	··
8	·19	·23	·22	·28	·27	·31	·22	·27	·27	·30	·29	·25	·24
9	·11	·07	·09	·13	·09	·10	·08	·05	·06	·05	·03	·06	·12
10	1·80	1·74	1·72	1·69	1·95	1·66	1·65	1·66	1·63	1·54	1·48	1·35	1·83
11	·46	·25	·11	·10	·15	·12	·12	·16	·21	·09	·02	·03	·11
12	·20	·15	·15	·21	·18	·30	·18	·12	·13	·15	·13	·12	·09
13	·01	·05	·17	·12	·11	·07	·12	·09	·12	·03	·01	·05	·06
14	·03	·02	·07	·17	·07	·02	·04	·02	·01	·10	·13	·01	·02
15	·02	·03	·02	·02	·02	··	·02	··	·01	··	·01	·02	·01
16	·09	·08	·09	·07	·09	·11	·08	·05	·07	·08	·05	·06	·09
17	·06	·05	·06	·03	·05	·02	·08	·03	·05	·03	·03	·01	·02
18	·02	·01	·01	·01	··	·01	·03	·01	·04	·02	··	··	·01
19	·05	·05	·05	·03	··	··	·05	·02	·04	·04	·01	··	··
20	·20	·24	·20	·21	·30	·19	·22	·18	·18	·20	·19	·15	·18
21	·03	·02	·06	·01	··	·06	·02	·04	·05	·03	·03	·03	·04
22	·14	·14	·12	·11	·10	·06	·09	·07	·06	·01	··	·12	·08
23	·04	·05	·06	·05	·06	·07	·07	·08	·08	·08	·13	·01	·07
24	·05	·06	·05	·04	·05	·06	·05	·05	·06	·12	·20	·29	·09
25	·01	·01	··	··	··	··	··	·01	··	·02	··	··	··
26	··	··	··	··	··	··	··	··	··	··	··	··	··
27	··	··	··	··	··	··	··	··	··	··	··	··	··
28	··	··	··	··	··	··	·01	··	··	··	··	··	··
29	·27	·28	·30	·29	·47	·37	·37	·33	·27	·25	·15	·20	·21
30	··	··	·04	··	··	··	··	··	·05	·01	·01	··	··
31	··	··	··	··	··	··	··	··	··	··	··	··	··
*	3·97	3·72	3·80	3·77	4·16	3·78	3·68	3·44	3·60	3·35	3·17	2·92	3·43
†	15·29	16·01	17·36	16·94	18·09	17·34	15·33	14·37	16·19	14·83	14·59	11·14	14·12

Day of Mo.	Bromley	Bromley Common	Beckenham (Foxgrove)	Beckenham (Cedars rd.)	South Norwood	Thornton Heath	Wimbledon (Sew. Wks.)	Wimbledon (Mt. Ararat)	Raynes Park	New Malden	Esher	Surbiton	Kingston
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	··	··	··	··	··	··	··	··	··	··	··	··	··
2	··	··	··	··	·01	·05	·03	·04	·05	·03	·06	·03	·06
3	··	··	··	··	··	··	··	··	··	··	··	··	··
4	··	··	··	··	··	··	··	··	··	··	··	··	··
5	··	··	··	··	··	··	··	··	··	··	··	··	··
6	·15	·18	·15	·16	·16	·15	·15	·10	·13	·05	·06	·03	·06
7	·01	··	··	··	·01	·01	·03	·04	·04	·04	·06	·05	·03
8	·23	·20	·20	·19	·18	·20	·28	·22	·22	·18	·12	·14	·15
9	·14	·11	·09	·10	·04	·05	·10	·02	·02	·02	·04	··	·05
10	1·69	1·54	1·56	1·56	1·85	1·80	1·46	1·40	1·35	1·24	·99	1·25	1·35
11	·13	·16	·20	·24	·44	·22	·08	·09	·10	·08	·15	·10	·15
12	·10	·15	·09	·08	·12	·13	·15	·10	·12	·15	·25	·35	·16
13	·08	·09	·02	·01	·03	·04	·30	·25	·25	··	·19	·17	·20
14	·04	·01	··	··	·02	·09	·14	·10	·08	·17	·18	·10	·48
15	·02	·02	·02	·03	·03	·02	·15	·04	·06	·16	·04	·03	·02
16	·10	·08	·09	·09	·10	·09	·07	·08	·09	·03	·05	·08	·09
17	·03	·07	·03	·02	·04	·03	·03	·02	·03	·06	·02	··	·01
18	·02	·02	··	··	·01	·01	··	·02	·02	·02	·01	··	·02
19	·02	·06	··	·10	·09	·06	·10	·06	·09	·02	·02	··	·06
20	·17	·20	·15	·15	·19	·13	·20	·21	·21	·19	·17	·24	·18
21	·07	·02	·05	·05	·03	·02	··	·01	·02	··	·02	··	··
22	·12	·07	·16	·20	·09	·12	·12	·07	·03	·07	·05	·04	·06
23	·08	·08	·06	·06	·04	·02	·04	·06	·07	·03	·02	··	·01
24	·09	·08	·05	·04	·05	·08	·20	·09	·11	·13	·17	·20	·15
25	·01	·01	··	·02	··	··	··	··	·02	·01	·02	··	·01
26	··	··	··	··	··	··	··	··	··	·01	·10	··	··
27	··	··	··	··	··	··	··	··	··	··	··	··	··
28	··	··	··	··	··	··	··	··	··	··	·02	··	··
29	·20	·33	·30	·33	·66	·41	1·14	1·20	·83	·95	·63	·70	1·79
30	·01	··	··	··	··	··	··	··	·01	··	·01	··	··
31	··	··	··	··	··	··	··	··	··	·01	··	··	··
*	3·51	3·48	3·22	3·43	4·19	3·73	4·77	4·22	3·95	3·65	3·45	3·51	5·09
†	14·55	14·59	13·47	13·81	14·66	14·32	15·72	15·63	16·88	12·95	13·82	14·32	17·41

* The figures in this row give the totals for the month. † The totals from January 1st.

Daily Rainfall. *50 years (1841-90) mean for Greenwich for July is 2·48 in.* **July, 1894**

Day of Mo.	Richmond	Wandswth. Common	Streatham	West Norwood	Forest Hill Dartmh.rd.	Forest Hill (Nurseries)	Forest Hill S.&V.W.C.	Eltham	Woolwich	Greenwich	Deptford	Nunhead	Brixton	Battersea
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	..	..	..	..	..	..	..	..	..	..	..	..	..
2	·08	·03	·04	·03	·03	·03	·02	..	·02	·03	..	·02	·03	·02
3	..	..	..	..	..	..	..	..	..	..	..	..	..	..
4	..	..	..	..	..	..	..	..	..	..	..	..	..	..
5	..	..	..	..	..	..	..	..	..	..	..	..	..	..
6	·06	·14	·13	·12	·16	·18	·14	·13	·11	·13	·10	·10	·14	·11
7	·01	·03	·01	·01	·02	..	·01	..	·02	·03	·01	·02	·04	·05
8	·14	·21	·23	·20	·22	·24	·18	·20	·17	·18	·15	·15	·20	·13
9	·03	·03	·03	·02	..	·02	·09	·08	·26	·16	·11	·16	·06	·05
10	1·06	1·38	1·63	1·70	1·58	1·55	1·53	1·68	1·57	1·40	1·41	1·40	1·46	1·15
11	·16	·09	·11	·15	·28	·40	·27	·15	·11	·40	·33	·21	·12	·16
12	·15	·04	·10	·16	·14	·18	·10	·17	·02	·07	·09	·08	·08	·03
13	·34	·18	·25	·09	·05	·03	·04	·04	·01	·05	·02	·01	·36	·18
14	·31	·22	·02	..	·04	..	·01	..	..	·02	·01	·01	·22	·07
15	·05	·03	·02	·02	·02	·01	·01	·02	·03	·04	·01	..	..	·01
16	·09	·05	·08	·08	·09	·09	·08	·08	·08	·10	·09	·08	·11	·08
17	·03	·02	·03	·03	·03	·02	·02	·01	..	..	..	·01	·01	..
18	..	..	..	..	..	..	..	..	·01	..	..	..	..	·03
19	·02	·01	·02	·02	..	..	..	..	·02	·02	..	·01	·02	..
20	·10	·14	·16	·15	·16	·04	·14	·11	·10	·12	·11	·13	·12	·10
21	·09	·01	·02	·10	·09	·08	·03	·02	..	..	..	..	·03	..
22	·01	·17	·06	·13	·15	·22	·14	·08	·08	·15	·14	·16	·06	·12
23	·15	·04	·03	·03	·05	·05	·04	·06	·08	·06	·03	·03	·02	·03
24	·01	·14	·06	·05	·08	·07	·09	·21	·24	·19	·12	·08	·05	·06
25	·01	..	·01	..	·02	·01	·01	..	..	..	..	..	..	..
26	..	..	..	..	..	..	..	..	..	..	..	..	..	·03
27	..	..	..	..	..	..	..	..	..	..	..	..	..	..
28	..	..	..	..	..	..	..	..	..	..	..	..	..	..
29	1·52	·53	·57	·38	·28	·22	·16	·16	·12	·11	·10	·10	·25	·14
30	..	·01	·01	..	..	..	..	..	..	..	..	..	..	..
31	..	..	..	..	..	·01	..	..	..	..	..	..	..	..
*	4·42	3·50	3·62	3·47	3·49	3·45	3·11	3·20	3·05	3·26	2·83	2·76	3·38	2·55
†	16·09	14·45	....	14·09	13·93	13·92	13·29	13·05	13·24	13·66	12·38	11·29	14·84	11·47

* The figures in this row give the totals for the month. † The totals from January 1st.

Note.—The observations are taken at 9 a.m., except at Brixton and Addington Park Farm (8 a.m.), Bromley (8.30 a.m.), South Norwood (8.45 a.m.), and Croydon (Waddon New Road) (10 a.m.).

NOTES.

(July, 1894.)

The month was rather cool, with a mean temperature but little above the average, wet and unsettled. The great rains on the 10th and 29th were unusually heavy, and at many stations the heaviest on record. At the Whitgift, Croydon, the rain on the 10th, 11th, and 12th, 2·41 in. fell in 48 hours, and of the rain on the 29th, there fell at Mt. Ararat, Wimbledon, 1·08 in. between 0.40 and 3 p.m., and at Kenley 0·43 in. fell between 2.30 and 3.30 p.m. Thunderstorms occurred on the 6th, 24th, and 29th at most stations in the district. The wet damp weather has given rise to a good deal of rheumatism. All vegetable crops have benefited, but corn and fruit have suffered, by the rain. A solar halo was seen on the 6th, and solar coronæ on the 22nd and 31st, at Upper Gatton. The mean temperature at Wallington was 61·9°, and at Waddon 62·8°, which is about 0·5° above the average. There were recorded at Woolwich 150·2 hours of bright sunshine, and at Wallington 175·3 hours of sunlight, which latter is 6 per cent. below the average.

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CROYDON MICROSCOPICAL AND NATURAL HISTORY CLUB *(Meteorological Subcommittee).*

Stations.	Observers.	Size of Gauge.	Height above Ground.		Height of Statn. ab. Sea-level.
		IN.	FT.	IN.	FT.
SURREY—					
Dorking (Denbies)	J. Beesley	5	0	6	610
Reigate Hill (Margery Hall)	W. F. Taylor	5	2	0	756
Upper Gatton	F. Druce	5	1	0	600
Caterham (Metropol. Asylum)	G. S. Elliott, M.D.	5	1	0	610
Caterham Valley (Congreg. Shl.)	Miss S. W. Rudd	5	1	0	500
Marden Park (Birchwood House)	Mrs. F. Rutley	5	1	0	471
KENT—					
Westerham (The Fishponds)	W. Morris	5	1	0	380
Knockholt (The Beeches)	W. Morris	5	1	0	785
SURREY—					
Warlingham (The Vicarage)	Rev. F. R. Marriott	5	1	0	614
Coulsdon (The Grange)	W. J. Stride	5	1	4	525
Kenley (Ingleside)	H. Smith	8	1	0	375
Purley (Tudor Cottages)	J. Bonwick	5	1	0	216
Ashtead (D'Abernon Chase)	Sir W. Vincent, Bart.	5	1	0	280
Oxshott	W. H. Dines	5	1	0	212
Epsom (Epsom College)	C. J. Gardiner	8	1	0	290
Banstead (The Larches)	Rev. C. J. Taylor	8	1	0	488
Sutton (Mulgrave Road)	W. Goode	5	5	6	230
Wallington (Maldon Road)	F. C. Bayard	5	4	1	140
Beddington (Riverside)	S. Rostron	5	1	0	120
Waddon (Waddon House)	P. Crowley	5	1	0	156
Croydon (Brimstone Barn)	Croydon Corporation	5	1	0	130
Croydon (Waddon New Road)	Croydon Corporation	5	1	0	146
Croydon (Duppas House)	Baldwin Latham	8	1	0	158
Croydon (Chatfield Road)	A. Malden	5	1	0	166
Croydon (Whitgift School)	A. E. Watson	5	1	0	191
Croydon (Park Hill Rise)	H. F. Parsons, M.D.	5	1	0	250
Croydon (Outram Road)	E. Mawley	8	0	9	202
Addington Hills (The Reservoir)	Croydon Corporation	8	0	9	473
Addington (Park Farm)	W. Whalley	5	1	0	268
Addington (Pumping Station)	Croydon Corporation	8	1	0	331
KENT—					
West Wickham (Wickham Ct.)	Sir J. F. Lennard, Bart.	5	1	2	300
West Wickham (Layham's Fm.)	W. Ashcroft	5	1	0	500
Hayes Common (The Warren)	Miss Akers	5	1	0	296

Stations.	Observers.	Size of Gauge.	Height above Ground.		Height of Statn. ab. Sea-level.
		IN.	FT.	IN.	FT.
KENT—					
Keston (Bradfield)	A. Hill	5	1	0	350
Keston (Tower Fields)	G. Buchanan	8	0	9	351
Orpington (Kent Water Co.)	W. Morris	5	1	0	220
Farningham Hill	A. J. Waring	5	3	0	300
Wilmington (Kent Water Co.)	W. Morris	5	1	0	25
Bickley (Highfield)	J. Batten	5	1	2	295
Bromley (Sundridge Avenue)	J. B. Snell	5	1	0	245
Bromley Common (Elmfield)	Rev. J. P. Faunthorpe	5	0	9	240
Beckenham (Foxgrove)	P. Bicknell	5	0	6	142
Beckenham (Cedars Road)	H. Dolling Smith	5	1	0	105
SURREY—					
South Norwood (Selhurst Road)	J. Potter	5	1	0	200
Thornton Heath (Thornton Rd.)	A. Wright	8	0	10	120
Wimbledon (Sewage Works)	C. H. Cooper	5	1	0	58
Wimbledon (Mount Ararat)	T. Devas	12	3	0	157
Raynes Park (Pumping Station)	C. H. Cooper	5	1	0	47
New Malden (Sewage Works)	T. V. H. Davison	5	1	0	45
Esher (Sewage Works)	W. H. Hope	5	1	0	40
Surbiton (Seething Wells)	R. Hack	10	0	6	25
Kingston (Sewage Works)	T. Stevens	5	1	0	25
Richmond (Ormond Lodge)	J. T. Billett	5	0	9	51
Wandsworth Com. (Patten Rd.)	F. J. Brodie	5	1	0	100
Streatham (Woodfield Avenue)	F. Jordan	5	1	0	120
West Norwood (Thornlaw Road)	W. Marriott	8	1	0	220
KENT—					
Forest Hill (Dartmouth Road)	Mrs. Behrens	5	1	0	220
Forest Hill (The Nurseries)	James Carter & Co.	6	0	6	76
Forest Hill (S. & V. Water Co.)	J. W. Restler	5	1	0	344
Eltham (High Street)	W. Morris	5	1	0	245
Woolwich (Powis Street)	J. G. Waller	5	30	0	65
Greenwich (Royal Observatory)	Astronomer Royal	8	0	5	155
Deptford (Kent Water Co.)	W. Morris	5	1	0	20
Nunhead (S. & V. Water Co.)	J. W. Restler	5	4	0	176
SURREY—					
Brixton (Acre Lane)	F. Gaster	8	1	0	77
Battersea (S. & V. Water Co.)	J. W. Restler	5	3	0	21

Daily Rainfall. *The 50 years (1841–90) mean at Greenwich for August is 2·34 in.* August, 1894.

Day of Mo.	Dorking	Reigate Hill	Upper Gatton	Caterham	Caterham Valley	Marden Park	Westerham	Knockholt	Warling-ham	Coulsdon	Kenley	Purley (Tudor C.)
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·02	·03	·01	·02		·02	·04		..	·02	..	·02
2	·05	·06	·07	·05		·05	·08		·10	·07	·09	·09
3	..	..	..	..		..	..		..	..	..	..
4	..	·01	·02	..		·02	..		·03	..	..	..
5	·03	·03	·04	·05		·02	·03		·04	·04	·03	·15
6	..	·01	·01	..		·01	·02		..	..	·01	·02
7	·05	·03	·04	·06		·04	·06		·08	·03	·03	·03
8	·05	·13	·15	·13		·12	·07		·10	·15	·11	·08
9	·03	·03	·02	..		..	..		·04	·03	..	..
10	·55	·27	·35	·27		·37	·30		·48	·36	·34	·52
11	..	·02	·01	..		·01	·01		·02	·01	·03	·04
12	·16	·15	·16	·16		·13	·16		·16	·16	·17	·15
13	·02	·03	·03	·03		·02	·03		·04	·02	·03	·03
14	..	..	..	..	RECORD CEASED.	..	·02	MONTHLY GAUGE.	..	..	·01	..
15	·16	·16	·13	·14		·12	·04		·31	·36	·46	·22
16	·28	·27	·23	·20		·13	·14		·10	·21	·26	·30
17	..	..	..	..		..	..		..	..	..	..
18	..	·01	..	..		..	..		·02	..	·02	..
19	·05	·02	·02	..		·01	..		·03	·02	·02	·04
20	..	..	..	..		..	..		..	..	..	..
21	..	·02	·02	·02		·01	..		·03	·03	·02	·03
22	·21	·13	·19	·29		·09	..		·26	·09	·11	·14
23	·57	1·00	·86	·70		·83	·96		·80	·88	·86	·93
24	·55	·80	·70	·67		·61	·27		·69	·84	·75	·88
25	·23	·05	·01	·07		·05	..		·03	·07	·11	·09
26	..	..	·01	..		..	..		..	..	..	..
27	..	..	..	..		..	..		..	..	..	..
28	..	·01	·01	..		..	..		..	..	..	..
29	..	..	·01	..		..	..		..	..	..	..
30	..	..	·01	..		..	..		..	..	..	..
31	..	..	..	..		..	..		..	..	..	..
*	3·01	3·27	3·11	2·86		2·66	2·23	3·00	3·36	3·39	3·46	3·76
†	22·71	21·93	23·90	22·83		18·52	20·81	20·08	23·45	20·78	22·43	21·47

Day of Mo.	Ashtead	Oxshott	Epsom	Banstead	Sutton	Wallington	Bedding-ton	Waddon	Croydon (Brim. Bn.)	Croydon (Wn.N.rd.)	Croydon Duppas H.	Croydon Chatfd. rd.	Croydon (Whitgift)	Croydon (Park Hill)
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	..	..	·01	..	..	..	..	..	..	..	..	·01	..
2	·31	·35	·06	·08	·25	·19	·19	·17	·23	·18	·18	·19	·21	·14
3	..	..	..	..	..	..	..	..	..	·01	..	·01	..	..
4	..	..	..	..	..	..	·01	·01	·02	·01	·01	..	..	·01
5	·05	·07	..	·03	·05	·04	·04	·03	·03	·04	·03	·04	·04	·05
6	·01	..	..	..	..	..	..	..	..	..	..	..	..	..
7	..	..	..	..	..	..	..	..	..	..	·01	..	..	..
8	·04	·04	..	·04	·06	·09	·10	·09	·09	·12	·11	·08	·10	·15
9	·01	..	..	..	..	..	..	..	..	·01	·01	..	..	..
10	·33	·42	·47	·54	·30	·31	·43	·50	·53	·47	·53	·62	·47	·34
11	·02	·03	..	·01	·02	·03	..	..	..	..	·01	..	..	..
12	·13	·12	·17	·16	·16	·16	·17	·16	·17	·16	·16	·16	·17	·16
13	·01	..	..	·01	·01	·01	·01	·02	·02	·02	·02	..	·02	·02
14	..	..	..	..	..	..	..	..	..	..	..	..	..	..
15	·07	·07	·07	·10	·08	·07	·07	·06	·09	·06	·06	·11	·08	·05
16	·43	·50	·11	·27	·18	·13	·15	·15	·13	·10	·11	·15	·15	·22
17	..	..	..	..	..	..	..	·01	..	·01	..	..	..	..
18	·06	·03	..	..	..	·11	·03	·03	·03	·02	·02	·02	·03	·03
19	·01	..	..	..	·02	·01	·01	·02	·02	·01	·02	..	·02	·02
20	..	..	..	..	..	..	..	..	..	..	..	..	..	..
21	..	..	..	·01	..	..	..	..	..	·01	..	..	..	..
22	·16	·11	·19	·12	·15	·14	·14	·14	·15	·34	·17	·13	·16	·14
23	·50	·60	·60	·77	·73	·79	·83	·81	·84	·58	·83	·84	·80	·91
24	·70	·53	·59	·64	·80	·80	·78	·74	·71	·72	·70	·59	·60	·50
25	·09	·19	·03	·06	·05	·06	·05	·06	·04	·01	·01	·09	·03	·08
26	..	..	..	..	..	..	..	..	..	..	..	..	..	..
27	..	..	..	..	..	..	..	·01	..	..	..	..	..	..
28	..	·01	..	..	..	..	..	..	..	..	..	..	..	..
29	..	..	..	..	..	..	..	..	..	..	..	..	..	..
30	·01	..	..	..	..	..	..	..	..	..	..	..	..	..
31	..	..	..	..	..	..	..	..	..	..	..	..	..	..
*	2·94	3·07	2·29	2·85	2·86	2·94	3·01	3·01	3·10	2·88	2·99	3·03	2·89	2·82
†	18·36	17·42	19·30	19·92	18·44	18·72	18·18	17·37	18·43	16·80	18·19	17·36	18·47	18·30

* The figures in this row give the totals for the month. † The totals from January 1st.

Day of Mo.	Croydon (Outm. Rd.)	Addington Hills	Addington (Park Fm.)	Addington (Pump. St.)	W. Wickhm Wickhm. C.	W. Wickhm Layhms. F.	Hayes Common	Keston (Bradfield)	Keston (Tow. Fds.)	Orpington
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·01	..	·01	..	..	..	..	..	..	·01
2	·13	·06	·09	·08	·16	·06	·06	·05	·05	·07
3	·01	..	·01	..	..	..	..	·01	..	..
4	·01	·01	·02	..	..	..	·01	·01	·01	·01
5	·05	·05	·03	·02	·03	·02	·03	·02	·02	·02
6	..	..	·03	·01	..	·01	..	·02	·01	·01
7	..	·01	·02	·02	..	·02	·02	·02	·02	·03
8	·14	·12	·14	·15	·16	·11	·17	·09	·14	·08
9	..	..	..	..	..	..	..	·01	..	·01
10	·31	·33	·24	·32	·26	·35	·30	·43	·39	·35
11	..	..	..	..	..	..	..	·01	..	..
12	·16	·18	·19	·17	·16	·18	·15	·13	·19	·14
13	·02	·02	·02	·02	..	·02	·02	·01	·01	·01
14	..	..	..	..	·01	..	..	..	..	..
15	·06	·23	·22	·40	·25	·37	·18	·30	·33	·29
16	·41	·16	·14	·15	·12	·07	·14	·14	·14	·28
17	..	..	·01	..	..	..	..	..	..	..
18	·03	·01	·01	·02	..	·07	..	·01	..	..
19	·02	·02	·02	·01	·03	·02	·03	·02	·02	..
20	..	..	..	..	..	..	..	..	..	..
21	·01	·01	·01	·01	..	·01	..	·01	..	..
22	·13	·14	..	·10	·12	·03	·10	·05	·02	·07
23	·82	·88	·90	·86	1·07	1·04	·99	1·20	1·20	1·11
24	·52	·56	·18	·49	·75	·03	·48	·11	·03	·21
25	·04	·09	·50	·10	·01	·40	·16	·35	·40	·30
26	..	..	..	..	..	..	..	..	..	..
27	..	·01	..	..	..	..	..	·01	..	·01
28	..	..	..	..	..	..	..	..	..	..
29	..	·01	..	..	..	..	..	..	..	..
30	..	..	..	..	..	..	..	..	..	..
31	..	..	..	..	..	·02	..	..	..	..
*	2·88	2·90	2·79	2·93	3·13	2·83	2·84	3·01	2·98	3·01
†	18·17	18·91	20·15	19·87	21·22	20·17	18·17	17·38	19·17	17·84

Day of Mo.	Farningham Hill	Wilmington	Bickley	Bromley	Bromley Common	Beckenham (Foxgrove)	Beckenham (Cedarsrd.)
	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·01	..	..	..	·01	RECORD CEASED.	..
2	·06	·04	·12	·19	·07		·15
3	..	..	..	·05	..		..
4	·01	·01	·03	..	·02		·01
5	..	..	·04	·08	·03		·05
6	·03	..	·01	..	·01		..
7	·02	..	..	..	·01		..
8	·05	·14	·17	·20	·16		·17
9	..	·05	..	..	·01		..
10	·28	·20	·41	·35	·35		·44
11	..	..	..	·01	·01		..
12	·10	·09	·13	·15	·13		·13
13	·01	·01	..	..	·01		·01
14	..	..	..	·02	..		..
15	·20	·26	·19	·19	·07		·35
16	·36	·41	·46	·39	·21		·14
17	..	..	..	·01	·01		..
18	·03	·03	·04	·04	·03		·03
19	·02	·01	·02	·03	·03		·02
20	..	..	..	..	..		..
21	·01	..	..	..	·01		..
22	·02	..	·07	·11	·10		·12
23	1·02	·96	1·08	·95	1·00		·87
24	·04	·27	·43	·35	·40		·38
25	·22	·07	·16	·15	·16		·17
26	..	..	..	..	..		..
27	..	..	..	·01	·01		..
28	..	..	..	..	..		..
29	..	..	..	..	..		..
30	..	..	..	..	..		..
31	..	..	..	..	..		..
*	2·49	2·55	3·36	3·28	2·85		3·04
†	17·08	13·69	17·48	17·83	17·44		16·85

Day of Mo.	South Norwood	Thornton Heath	Wimbledon (Sew. Wks.)	Wimbledon (Mt. Ararat)	Raynes Park	New Malden	Esher	Surbiton	Kingston
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	..	·03	·01	·04	·02	·02	..	..
2	·23	·26	·10	·13	·16	·11	·14	·14	·10
3	..	..	..	..	·01	..	·02	..	..
4	..	..	..	..	..	..	..	..	..
5	·05	·07	·15	·14	·13	·13	·06	·13	·10
6	..	..	·01	·02	..	..	·02	..	..
7	..	..	·01	·01	·03	..	..	..	..
8	·13	·10	·04	·07	·11	·10	·12	·12	·05
9	·01	..	·01	..	·02	·01	..	..	·01
10	·68	·63	·41	·39	·36	·09	·54	·29	·16
11	..	..	..	·01	·03	·10	·04	·05	·11
12	·14	·15	·15	·16	·18	·16	·12	·16	·20
13	·02	..	·01	·01	·03	..	·02	..	·01
14	..	..	..	..	..	..	..	..	..
15	·21	·16	·15	·17	·12	..	·10	·13	·22
16	·18	·20	·17	·10	·14	·27	·51	·24	·28
17	..	..	·01	..	·01	..	..	..	..
18	·03	·04	·04	·07	·10	..	·02	..	·04
19	·02	..	·02	·02	·05	·01	·02	..	·03
20	..	..	..	..	..	..	..	..	..
21	..	..	..	..	·01	..	..	..	..
22	·12	·19	·16	..	·16	·14	·13	·13	·27
23	·92	·77	·69	·88	·75	·56	·43	·55	·52
24	·50	·38	·58	·40	·57	·65	·33	·71	·70
25	·09	·37	·18	·32	·17	·09	·03	·01	..
26	..	..	..	..	·02	..	..	..	..
27	..	..	..	·01	..	..	..	..	..
28	..	..	..	..	..	..	..	..	..
29	..	..	..	·01	..	..	..	..	..
30	..	..	..	..	..	..	..	..	..
31	..	..	..	..	..	..	..	..	..
*	3·33	3·32	2·92	2·93	3·20	2·44	2·67	2·66	2·80
†	17·99	17·64	18·64	18·56	20·08	15·39	16·49	16·98	20·21

* The figures in this row give the totals for the month. † The totals from January 1st.

Daily Rainfall. *50 years (1841-90) mean for Greenwich for Aug. is 2·34 in.* **August, 1894.**

Day of Mo.	Richmond	Wandswth. Common	Streatham	West Norwood	Forest Hill Dartmh.rd.	Forest Hill (Nurseries)	Forest Hill S.&V.W.C.	Eltham	Woolwich	Greenwich	Deptford	Nunhead	Brixton	Battersea
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·02	·02	..	·01	·01	·01	..	..	·01	..	..	..	..	..
2	·08	·05	·10	·20	·20	·26	·12	·17	·04	·06	·05	·05	·08	·04
3	..	..	..	..	..	..	..	..	..	..	..	..	..	..
4	·01	·02	..	·01	..	..	·02	·01	·04	·03	·02	..	·01	·03
5	·10	·15	·12	·11	·12	·12	·12	·10	·15	·15	·13	·13	·14	·11
6	..	·01	..	..	·01	..	·01	·02	..	..	..	..	..	..
7	·01	·01	·01	..	·02	..	..	..	..	..	..	..	..	..
8	·14	·03	·06	·01	·09	·10	·08	·05	·06	·06	·05	·05	·07	·03
9	·03	·02	·02	·10	·01	..	..	..	..	..	..	..	..	..
10	·16	·78	·66	·50	·36	·46	·47	·50	·67	·28	·28	·49	·44	·51
11	·03	·01	·01	..	..	..	..	..	..	..	..	..	..	..
12	·14	·11	·15	·15	·15	·16	·15	·10	·10	·12	·11	·12	·15	·12
13	·01	·02	·02	·03	·02	·02	·01	·01	·01	·01	..	..	·01	·01
14	..	..	..	..	..	..	..	..	..	..	..	..	..	..
15	·12	·05	·13	·18	·13	·05	·10	·08	·08	·07	·07	·05	·07	·10
16	·14	·33	·34	·20	·25	·30	·26	·46	·46	·70	·53	·30	·28	·31
17	..	·01	·01	..	..	..	..	..	..	..	..	..	..	..
18	·08	·11	·11	·11	·04	..	·04	·06	·01	·04	·03	..	·07	·03
19	·04	·03	·04	·03	·05	·04	·04	·02	·02	·03	·02	·03	·03	·03
20	..	..	..	..	..	..	..	..	..	..	..	..	..	..
21	..	·01	..	..	..	..	..	..	..	..	..	..	..	..
22	·15	·16	·11	·15	·13	·02	·12	·08	·08	·13	·11	·13	·02	·13
23	·50	·63	·82	1·00	·80	·95	·75	1·04	·98	·84	·83	·88	·94	·61
24	·62	·43	·54	·47	·46	·10	·31	·35	·17	·25	·32	·30	·28	·28
25	·13	·07	·17	·17	·09	·01	·19	·25	·35	·26	·16	·12	·41	·25
26	..	..	..	..	..	..	..	..	..	..	..	..	..	..
27	..	..	..	..	..	..	..	..	..	..	..	..	..	..
28	..	..	..	..	..	..	..	..	..	..	..	..	..	..
29	..	..	..	..	..	..	..	..	..	..	..	..	..	..
30	..	..	..	..	..	..	..	..	..	..	..	..	..	..
31	..	..	..	..	..	..	..	..	..	..	..	..	..	..
*	2·51	3·06	3·42	3·43	2·94	2·60	2·79	3·30	3·23	3·03	2·71	2·65	3·00	2·59
†	18·60	17·51	....	17·52	16·87	16·52	16·08	16·35	16·47	16·69	15·09	13·94	17·84	14·06

* The figures in this row give the totals for the month. † The totals from January 1st.

Note.—The observations are taken at 9 a.m., except at Brixton and Addington Park Farm (8 a.m.), Bromley (8.30 a.m.), South Norwood (8.45 a.m.), and Croydon (Waddon New Road) (10 a.m.).

NOTES.

(August, 1894.)

The month has been cold, wet, and rather sunless, in character very similar to August, 1891. The last six days were fine, accompanied by heavy dews, and in many places by thick mists. The month has consequently been unfavourable for harvest operations. Influenza has been prevalent in parts of the district. At Upper Gatton, on the 24th, ·38 in. of the amount recorded fell between 7 p.m. and 7.10 p.m. in a thunderstorm. Solar halos were seen at Upper Gatton on the 5th and 7th. The mean temperature at Wallington was 60·3°, and at Waddon 60·6°, which is about 0·5° below the average. There were recorded at Woolwich 112½ hours of bright sunshine, and at Wallington 143·9 hours of sunlight, which latter amount is 13 per cent. below the average.

Francis Campbell Bayard, F.R.Met. Soc.,
Hon. Sec.

CROYDON MICROSCOPICAL AND NATURAL HISTORY CLUB (*Meteorological Subcommittee*).

Stations.	Observers.	Size of Gauge.	Height above Ground.		Height of Statn. ab. Sea-level.
		IN.	FT.	IN.	FT.
Surrey—					
Abinger (The Rectory)	Miss Brodie-Hall	5	1	0	381
Dorking (Denbies)	J. Beesley	5	0	6	610
Reigate Hill (Margery Hall)	W. F. Taylor	5	2	0	756
Upper Gatton	F. Druce	5	1	0	600
Caterham (Metropol. Asylum)	G. S. Elliott, M.D.	5	1	0	610
Marden Park (Birchwood House)	Mrs. F. Rutley	5	1	0	471
Kent—					
Westerham (The Fishponds)	W. Morris	5	1	0	380
Knockholt (The Beeches)	W. Morris	5	1	0	785
Surrey—					
Warlingham (The Vicarage)	Rev. F. R. Marriott	5	1	0	614
Coulsdon (The Grange)	W. J. Stride	5	1	4	525
Kenley (Ingleside)	H. Smith	8	1	0	375
Purley (Tudor Cottages)	J. Bonwick	5	1	0	216
Ashtead (D'Abernon Chase)	Sir W. Vincent, Bart.	5	1	0	280
Oxshott	W. H. Dines	5	1	0	212
Epsom (Epsom College)	C. J. Gardiner	8	1	0	290
Banstead (The Larches)	Rev. C. J. Taylor	8	1	0	488
Sutton (Mulgrave Road)	W. Goode	5	5	6	230
Wallington (Maldon Road)	F. C. Bayard	5	4	1	140
Beddington (Riverside)	S. Rostron	5	1	0	120
Waddon (Waddon House)	P. Crowley	5	1	0	156
Croydon (Brimstone Barn)	Croydon Corporation	5	1	0	130
Croydon (Waddon New Road)	Croydon Corporation	5	1	0	146
Croydon (Duppas House)	Baldwin Latham	8	1	0	158
Croydon (Chatfield Road)	A. Malden	5	1	0	166
Croydon (Whitgift School)	A. E. Watson	5	1	0	191
Croydon (Park Hill Rise)	H. F. Parsons, M.D.	5	1	0	250
Croydon (Outram Road)	E. Mawley	8	0	9	202
Addington Hills (The Reservoir)	Croydon Corporation	8	0	9	473
Addington (Park Farm)	W. Whalley	5	1	0	268
Addington (Pumping Station)	Croydon Corporation	8	1	0	331
Kent—					
West Wickham (Wickham Ct.)	Sir J. F. Lennard, Bart.	5	1	2	300
West Wickham (Layham's Fm.)	W. Ashcroft	5	1	0	500
Hayes Common (The Warren)	Miss Akers	5	1	0	296

Stations.	Observers.	Size of Gauge.	Height above Ground.		Height of Statn. ab. Sea-level.
		IN.	FT.	IN.	FT.
Kent—					
Keston (Bradfield)	A. Hill	5	1	0	350
Keston (Tower Fields)	G. Buchanan	8	0	9	351
Orpington (Kent Water Co.)	W. Morris	5	1	0	220
Farningham Hill	A. J. Waring	5	3	0	300
Wilmington (Kent Water Co.)	W. Morris	5	1	0	25
Bickley (Highfield)	J. Batten	5	1	2	295
Bromley (Sundridge Avenue)	J. B. Snell	5	1	0	245
Bromley Common (Elmfield)	Rev. J. P. Faunthorpe	5	0	9	240
Beckenham (Cedars Road)	H. Dolling Smith	5	1	0	105
Surrey—					
South Norwood (Selhurst Road)	J. Potter	5	1	0	200
Thornton Heath (Thornton Rd.)	A. Wright	8	0	10	120
Wimbledon (Sewage Works)	C. H. Cooper	5	1	0	58
Wimbledon (Mount Ararat)	T. Devas	12	3	0	157
Raynes Park (Pumping Station)	C. H. Cooper	5	1	0	47
New Malden (Sewage Works)	T. V. H. Davison	5	1	0	45
Esher (Sewage Works)	W. H. Hope	5	1	0	40
West Molesey (Chelsea W. Co.)	R. Hack	5	1	0	32
Surbiton (Seething Wells)	R. Hack	10	0	6	25
Kingston (Sewage Works)	T. Stevens	5	1	0	25
Richmond (Ormond Lodge)	J. T. Billett	5	0	9	51
Wandsworth Com. (Patten Rd.)	F. J. Brodie	5	1	0	100
Streatham (Woodfield Avenue)	F. Jordan	5	1	0	120
West Norwood (Thornlaw Road)	W. Marriott	8	1	0	220
Kent—					
Forest Hill (Dartmouth Road)	Mrs. Behrens	5	1	0	220
Forest Hill (The Nurseries)	James Carter & Co.	6	0	6	76
Forest Hill (S. & V. Water Co.)	J. W. Restler	5	1	0	344
Eltham (High Street)	W. Morris	5	1	0	245
Woolwich (Powis Street)	J. G. Waller	5	30	0	65
Greenwich (Royal Observatory)	Astronomer Royal	8	0	5	155
Deptford (Kent Water Co.)	W. Morris	5	1	0	20
Nunhead (S. & V. Water Co.)	J. W. Restler	5	4	0	176
Surrey—					
Brixton (Acre Lane)	F. Gaster	8	1	0	77
Battersea (S. & V. Water Co.)	J. W. Restler	5	3	0	21

Daily Rainfall. *The 50 years (1841–90) mean at Greenwich for September is 2·25 in.* **September, 1894.**

Day of Mo.	Abinger	Dorking	Reigate Hill	Upper Gatton	Caterham	Marden Park	Westerham	Knockholt	Warling-ham	Coulsdon	Kenley	Purley (Tudor C.)
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	..	..	..	..	..	..		..	..	..	..
2	·11	·09	·08	·09	·05	·10	·10		..	·05	·02	·01
3	·21	·15	·27	·28	·29	·16	·30		·40	·22	·19	·20
4	..	..	..	..	·03	..	·26		·20	·04	·05	·16
5	..	..	·03	·29	·03	·03	..		·11	·03	..	·04
6	·24	·18	·08	·09	·04	·04	·05		·08	·03	·03	·05
7	·65	·55	·54	·49	·41	·38	·30		·38	·41	·38	·40
8	..	..	·02	·01	..	..	·03		..	..	·01	..
9	·04	·02	·03	·02	·02	·06	..		·09	·04	·02	·02
10	..	..	..	..	..	..	..		..	..	..	..
11	..	..	..	..	..	..	..		..	..	..	..
12	..	..	..	..	..	..	..		..	..	..	..
13	..	..	..	..	..	..	..		..	..	..	..
14	..	..	..	..	..	..	..		..	..	..	..
15	..	..	·01	..	..	..	..	MONTHLY GAUGE.	..	..	..	..
16	·03	·04	·05	·07	·06	·06	·03		·10	·05	·05	·07
17	..	..	..	..	·01	..	..		·02	..	·01	..
18	..	..	..	·01	..	..	..		..	..	..	..
19	..	..	·02	·01	..	..	..		..	..	·02	..
20	..	..	..	..	..	..	·01		..	..	..	..
21	·11	·12	·10	·06	·06	·04	·02		·11	·08	·12	·14
22	·25	·33	·40	·48	·41	·14	·26		·35	·36	·35	·33
23	·04	·04	·07	·05	·03	·27	·30		·02	·02	..	·05
24	·51	·28	·28	·28	·25	·25	·34		·33	·22	·26	·29
25	·16	·08	·09	·10	·15	·08	·06		·14	·14	·11	·14
26	·03	·03	·04	·05	·05	·04	..		·04	·06	·04	·05
27	..	..	..	·01	..	..	..		..	..	..	..
28	·03	..	..	·01	..	..	..		..	..	..	..
29	..	..	·01	·01	..	..	..		..	..	..	..
30	..	..	..	..	..	..	..		..	..	..	..
*	2·41	1·91	2·12	2·41	1·89	1·65	2·06	2·04	2·37	1·75	1·66	1·95
†	....	24·62	24·05	26·31	24·72	20·17	22·87	22·12	25·82	22·53	24·09	23·42

Day of Mo.	Ashtead	Oxshott	Epsom	Banstead	Sutton	Wallington	Bedding-ton	Waddon	Croydon (Brim. Bn.)	Croydon (Wn.N.rd.)	Croydon Duppas H.	Croydon Chatfd. rd.	Croydon (Whitgift)	Croydon (Park Hill)
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	..	..	..	..	..	..	..	..	..	..	..	..	..
2	·03	·06	..	..	..	..	..	..	..	·01	..	..	..	..
3	..	·06	·30	·17	·14	·12	·13	·16	·14	·13	·15	·14	·16	·16
4	·07	..	..	..	..	·01	·07	·17	·14	·16	·17	·10	·26	·08
5	·17	·01	·18	·15	..	·08	·17	·18	·14	·18	·28	·08	·12	·07
6	..	·25	·17	·10	·10	·05	·04	·02	·03	·02	·01	·01	·02	·01
7	·57	·55	·49	·47	·42	·38	·37	·36	·36	·36	·36	·36	·37	·30
8	·01	..	..	..	..	..	..	·01	·12	·01	..	..	·01	..
9	·01	·03	·08	·04	·06	·02	·03	·03	·04	·02	·03	·01	·03	·02
10	..	..	..	..	..	..	..	..	..	..	..	..	..	..
11	..	..	..	..	..	..	..	..	..	..	..	..	..	..
12	..	..	..	..	..	..	..	..	..	..	..	..	..	..
13	..	..	..	..	..	..	..	..	..	..	..	..	..	..
14	..	..	..	..	..	..	..	..	..	..	..	..	..	..
15	..	..	..	..	..	..	..	..	..	·01	..	..	·01	·01
16	·05	·04	..	·05	·04	·03	·03	·03	·04	·03	·04	·03	·04	·03
17	·01	..	..	..	·01	..	..	..	..	..	..	..	..	..
18	..	..	..	..	·01	..	..	..	..	..	·01	..	..	..
19	·01	..	..	..	..	..	..	..	..	..	..	..	..	..
20	..	..	..	..	..	..	..	..	..	..	..	..	..	..
21	·05	·06	·07	·09	·07	·10	·10	·11	·09	·12	·10	·11	·10	·10
22	·19	·21	·24	·35	·27	·30	·35	·35	·35	·32	·35	·35	·39	·36
23	·03	·04	..	..	·09	·01	·02	·01	·02	·01	·01	·01	..	·01
24	·17	·16	·28	·26	·24	·20	·22	·23	·25	·24	·26	·26	·29	·31
25	·10	·10	·10	·12	·16	·16	·15	·14	·16	·15	·16	·17	·19	·20
26	·02	·01	·03	·03	·03	·03	·02	·02	·04	·02	·02	·02	·03	·02
27	..	..	..	..	·01	..	..	..	..	..	..	..	..	..
28	..	..	..	..	..	..	..	..	..	..	·01	..	..	..
29	..	..	..	..	..	..	..	..	..	..	..	..	..	..
30	·01	..	..	..	·01	..	..	..	..	..	..	..	..	..
*	1·50	1·58	1·94	1·83	1·66	1·49	1·70	1·82	1·92	1·79	1·96	1·65	2·02	1·74
†	19·86	19·00	21·24	21·75	20·10	20·21	19·88	19·19	20·35	18·59	20·15	19·01	20·49	20·04

* The figures in this row give the totals for the month. † The totals from January 1st.

Daily Rainfall. *The 50 years (1841–90) mean at Greenwich for September is 2·25 in.* **September, 1894.**

Day of Mo.	Croydon (Outm.Rd.)	Addington Hills	Addington (Park Fm.)	Addington (Pump. St.)	W.Wickhm Wickhm.C.	W.Wickhm Layhms.F.	Hayes Common	Keston (Bradfield)	Keston (Tow. Fds.)	Orpington	Farningham Hill	Wilmington	Bickley	Bromley	Bromley Common	Beckenham (Cedars rd.)	South Norwood	Thornton Heath	Wimbledon (Sew. Wks.)	Wimbledon (Mt.Ararat)	Raynes Park	New Malden	Esher	West Molesey	Surbiton	Kingston
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..		..	..	·01	..	..	..	..	..	..
2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..		..	..	..	·01	..	..	..	..	..
3	·16	·19	·21	·23	·25	·33	·21	·23	·32	·33	·25	·13	·24	·23	·22	·15		·14	·07	·06	·06	·05	·01	..	·04	·04
4	·08	·07	·07	·06	·06	·03	·06	·05	·03	..	..	..	·03	·04	·06	·03		·11	·01	..	..	..	..	..	..	..
5	·05	·11	·05	·05	·15	·09	·02	·02	..	·02	..	..	..	..	·01	..		·07	..	·03	·04	·03	..	..	..	·02
6	·01	·06	·13	·13	·04	·02	·03	·03	·01	..	·03	·02	·01	..	·01	·07		·02	·13	·07	·06	·17	·12	·10	·16	..
7	·34	·36	·36	·35	·40	·33	·33	·34	·32	·32	·34	·32	·34	·32	·31	·33		·34	·53	·38	·38	·40	·44	·46	·43	·45
8	·01	..	·03	·02	..	·04	..	..	·02	..	·02	·02	..	..	·01	·01		·01	·01	..	·02	..	·01	..	..	..
9	·06	·03	·06	·03	·08	·07	·08	·06	·06	·03	·05	·02	·07	·06	·06	·02		·03	·06	·06	·07	·02	·01	·02	..	·03
10	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..		..	..	·01	..	..	..	..	..	..
11	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..		..	..	..	..	..	..	..	..	..
12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..		..	..	..	..	..	..	..	..	..
13	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..		..	..	..	..	..	..	..	..	..
14	..	·01	..	..	..	..	..	·01	·01	..	..	..	..	·01	..	..		..	..	..	..	..	..	..	..	..
15	·02	·01	..	..	·01	..	·02	·02	·02	·02	·02	·01	·03	·03	·02	·01		·01	..	·01	·02	..	..	..	..	..
16	·04	·06	·05	·05	·05	·06	·04	·06	·06	·06	·05	·02	·04	·05	·06	·03	RECORD CEASED.	..	·02	·01	·03	..	..	..	..	..
17	..	·01	..	·01	..	·01	·01	·01	..	·01	·01	..	·01	·02	·01	·01		..	..	..	..	..	..	..	..	..
18	..	·01	·01	·01	..	·01	..	·01	..	..	·01	..	..	·01	·01	..		..	..	..	..	..	..	..	..	..
19	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..		..	..	..	..	..	..	..	..	..
20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..		..	..	..	..	..	..	..	..	..
21	·09	·12	·08	·09	·09	·07	·08	..	·08	·10	·05	·08	·08	·09	·08	·09		·16	·07	·08	·07	..	·06	·08	·07	·08
22	·35	·35	·22	·35	·39	·30	·35	·37	·33	·26	·15	·20	·45	·44	·40	·33		·22	·22	·24	·26	·19	·20	·14	·15	·17
23	·04	·02	..	..	·11	·05	·02	·05	·14	·07	·21	·05	·14	·07	·20	·01		..	·02	·13	·18	..	·03	·01	..	..
24	·33	·37	·34	·34	·30	·29	·40	·32	·32	·34	·34	·25	·31	·30	·29	·32		·25	·17	·20	·22	·44	·08	·22	·36	·45
25	·17	·20	·16	·12	·13	·09	·15	·12	·12	·11	·05	·10	·15	·18	·13	·16		·18	·15	·08	·12	·02	·03	·03	·03	·05
26	·02	·03	·05	·02	·03	·05	·03	·01	·04	·03	·04	..	·02	·03	·03	·03		·03	·02	·04	·05	·04	·02	..	·01	·03
27	..	·01	..	..	..	..	..	..	..	..	..	..	..	·01	..	..		..	..	..	..	..	..	..	..	..
28	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..		..	..	..	..	..	..	..	..	..
29	..	·01	..	..	..	..	..	..	..	·02	·03	·01	..	..	..	..		..	..	..	·02	..	..	·01	..	..
30	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..		..	..	·01	..	..	..	..	..	..
*	1·78	2·03	1·82	1·86	2·09	1·84	1·83	1·71	1·88	1·72	1·65	1·23	1·92	1·90	1·91	1·60		1·57	1·48	1·42	1·61	1·36	1·01	1·07	1·25	1·32
†	19·95	20·94	21·97	21·73	23·31	22·01	20·00	19·09	21·05	19·56	18·73	14·92	19·40	19·73	19·35	18·45		19·21	20·12	19·98	21·69	16·75	17·50	....	18·23	21·53

* The figures in this row give the totals for the month. † The totals from January 1st.

Daily Rainfall. *50 years (1841-90) mean for Greenwich for Sep. is 2·25 in.* **September, 1894.**

Day of Mo.	Richmond	Wandswth. Common	Streatham	West Norwood	Forest Hill Dartmh.rd.	Forest Hill (Nurseries)	Forest Hill S.&V.W.C.	Eltham	Woolwich	Greenwich	Deptford	Nunhead	Brixton	Battersea
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	..	..	..	..	..	..	..	..	..	..	..	..	..
2	..	..	..	..	..	..	..	..	..	..	..	..	..	..
3	·04	·05	·11	·12	·13	·14	·10	·18	·13	·16	·11	·09	·07	·02
4	..	·08	·12	·12	·04	..	·04	..	..	·02	·03	·01	·07	·05
5	..	·02	·01	..	..	..	..	..	..	..	..	..	·01	..
6	·18	·11	·11	·04	..	..	..	..	..	·01	·01	..	·07	·08
7	·37	·33	·35	·34	·33	·36	·33	·35	·29	·34	·33	·32	·32	·31
8	..	·02	·01	..	..	·02	..	·02	..	..	..	·01	·01	..
9	·03	·05	·05	·04	·03	·02	·03	·05	·05	·02	·01	·03	·05	·08
10	..	..	..	..	..	..	..	..	..	..	..	..	..	..
11	..	..	..	..	..	..	..	..	..	..	..	..	..	..
12	..	..	..	..	..	..	..	..	..	..	..	..	..	..
13	..	..	..	..	..	..	..	..	..	..	..	..	..	..
14	..	..	..	..	..	..	..	..	..	..	..	..	..	..
15	..	·01	·01	·02	·03	..	·03	·02	..	·01	..	..	·01	..
16	..	..	·01	·01	..	..	·01	·02	·01	·01	..	·01	..	..
17	..	·01	·02	·01	·03	·01	·01	·01	..	..	..	..	·01	..
18	..	..	..	..	..	..	..	..	..	..	..	..	..	..
19	..	..	..	..	..	..	..	..	..	..	..	..	..	..
20	..	..	..	..	..	..	..	..	..	..	..	..	..	..
21	·12	·08	·06	·04	·10	·05	·05	·10	·07	·06	·04	·04	·08	·05
22	·20	·26	·24	·25	·21	·33	·22	·30	·31	·25	·23	·19	·23	·14
23	·03	·02	·02	·02	..	·02	·03	·22	·10	·01	..	·01	·03	..
24	·35	·14	·21	·23	·20	·25	·18	·33	·26	·27	·21	·19	·20	·10
25	·07	·11	·19	·21	·16	·12	·13	·14	·12	·07	·07	·12	·14	·04
26	·01	·01	·03	·03	·02	·03	·02	·02	·01	·02	..	·01	·01	..
27	..	..	..	..	..	..	..	..	..	..	..	..	..	..
28	..	..	..	..	..	..	..	..	..	..	..	..	..	..
29	..	..	..	..	..	..	..	..	..	..	..	..	..	..
30	..	..	..	..	..	..	..	..	..	..	..	..	..	..
*	1·40	1·30	1·55	1·48	1·28	1·35	1·18	1·76	1·35	1·25	1·04	1·03	1·31	·87
†	20·00	18·81	....	19·00	18·15	17·87	17·26	18·11	17·82	17·94	16·13	14·97	19·15	14·93

* The figures in this row give the totals for the month. † The totals from January 1st.

Note.—The observations are taken at 9 a.m., except at Brixton and Addington Park Farm (8 a.m.), Bromley (8.30 a.m.), South Norwood (8.45 a.m.), and Croydon (Waddon New Road) (10 a.m.).

NOTES.

(September, 1894.)

The month has been cool, sunless and somewhat wet, though the amount of rain is under the average. Northerly winds have been prevalent, but not high. The mean pressure and the mean amount of cloud are the highest in the Wallington Record; whilst the mean max. in shade, the mean temperature, and the percentage of sunlight, are the lowest in the same record. There is much illness about here. Solar halos were seen at Croydon on the 5th and 7th, and at Wallington on the 13th. Frosts on the grass and in the air occurred in parts of the district, but were not general. The mean temperature at Waddon was 53·4°, at Wallington 54°, and at Croydon (Duppas House) 54·9°, and is about 3° below the average. There were recorded at Woolwich 71¾ hours of bright sunshine, and at Wallington 82·3 hours of sunlight, which latter amount is 22 per cent. below the average.

Francis Campbell Bayard, F.R.Met.Soc.,
Hon. Sec.

CROYDON MICROSCOPICAL AND NATURAL HISTORY CLUB *(Meteorological Subcommittee).*

Stations.	Observers.	Size of Gauge.	Height above Ground.		Height of Statn. ab. Sea-level.
		IN.	FT.	IN.	FT.
Surrey—					
Abinger (The Rectory)	Miss Brodie-Hall	5	1	0	381
Dorking (Denbies)	J. Beesley	5	0	6	610
Reigate Hill (Margery Hall)	W. F. Taylor	5	2	0	756
Upper Gatton	F. Druce	5	1	0	600
Caterham (Metropol. Asylum)	G. S. Elliott, M.D.	5	1	0	610
Marden Park (Birchwood House)	Mrs. F. Rutley	5	1	0	471
Kent—					
Westerham (The Fishponds)	W. Morris	5	1	0	380
Knockholt (The Beeches)	W. Morris	5	1	0	785
Surrey—					
Warlingham (The Vicarage)	Rev. F. R. Marriott	5	1	0	614
Coulsdon (The Grange)	W. J. Stride	5	1	4	525
Kenley (Ingleside)	H. Smith	8	1	0	375
Purley (Tudor Cottages)	J. Bonwick	5	1	0	216
Ashtead (D'Abernon Chase)	Sir W. Vincent, Bart.	5	1	0	280
Oxshott	W. H. Dines	5	1	0	212
Epsom (Epsom College)	C. J. Gardiner	8	1	0	290
Banstead (The Larches)	Rev. C. J. Taylor	8	1	0	488
Sutton (Mulgrave Road)	W. Goode	5	5	6	230
Wallington (Maldon Road)	F. C. Bayard	5	4	1	140
Beddington (Riverside)	S. Rostron	5	1	0	120
Waddon (Waddon House)	P. Crowley	5	1	0	156
Croydon (Brimstone Barn)	Croydon Corporation	5	1	0	130
Croydon (Waddon New Road)	Croydon Corporation	5	1	0	146
Croydon (Duppas House)	Baldwin Latham	8	1	0	158
Croydon (Chatfield Road)	A. Malden	5	1	0	166
Croydon (Whitgift School)	A. E. Watson	5	1	0	191
Croydon (Park Hill Rise)	H. F. Parsons, M.D.	5	1	0	250
Croydon (Outram Road)	E. Mawley	8	0	9	202
Addington Hills (The Reservoir)	Croydon Corporation	8	0	9	473
Addington (Park Farm)	W. Whalley	5	1	0	268
Addington (Pumping Station)	Croydon Corporation	8	1	0	331
Kent—					
West Wickham (Wickham Ct.)	Sir J. F. Lennard, Bart.	5	1	2	300
West Wickham (Layham's Fm.)	W. Ashcroft	5	1	0	500
Hayes Common (The Warren)	Miss Akers	5	1	0	296

Stations.	Observers.	Size of Gauge.	Height above Ground.		Height of Statn. ab. Sea-level.
		IN.	FT.	IN.	FT.
Kent—					
Keston (Bradfield)	A. Hill	5	1	0	350
Keston (Tower Fields)	G. Buchanan	8	0	9	351
Orpington (Kent Water Co.)	W. Morris	5	1	0	220
Farningham Hill	A. J. Waring	5	3	0	300
Wilmington (Kent Water Co.)	W. Morris	5	1	0	25
Bickley (Highfield)	J. Batten	5	1	2	295
Bromley (Sundridge Avenue)	J. B. Snell	5	1	0	245
Bromley Common (Elmfield)	Rev. J. P. Faunthorpe	5	0	9	240
Beckenham (Cedars Road)	H. Dolling Smith	5	1	0	105
Surrey—					
South Norwood (Selhurst Road)	J. Potter	5	1	0	200
Thornton Heath (Thornton Rd.)	A. Wright	8	0	10	120
Wimbledon (Sewage Works)	C. H. Cooper	5	1	0	58
Wimbledon (Mount Ararat)	T. Devas	12	3	0	157
Raynes Park (Pumping Station)	C. H. Cooper	5	1	0	47
New Malden (Sewage Works)	T. V. H. Davison	5	1	0	45
Esher (Sewage Works)	W. H. Hope	5	1	0	40
West Molesey (Chelsea W. Co.)	R. Hack	5	1	0	32
Surbiton (Seething Wells)	R. Hack	10	0	6	25
Kingston (Sewage Works)	T. Stevens	5	1	0	25
Richmond (Ormond Lodge)	J. T. Billett	5	0	9	51
Wandsworth Com. (Patten Rd.)	F. J. Brodie	5	1	0	100
Streatham (Woodfield Avenue)	F. Jordan	5	1	0	120
West Norwood (Thornlaw Road)	W. Marriott	8	1	0	220
Kent—					
Forest Hill (Dartmouth Road)	Mrs. Behrens	5	1	0	220
Forest Hill (The Nurseries)	James Carter & Co.	6	0	6	76
Forest Hill (S. & V. Water Co.)	J. W. Restler	5	1	0	344
Eltham (High Street)	W. Morris	5	1	0	245
Woolwich (Powis Street)	J. G. Waller	5	30	0	65
Greenwich (Royal Observatory)	Astronomer Royal	8	0	5	155
Deptford (Kent Water Co.)	W. Morris	5	1	0	20
Nunhead (S. & V. Water Co.)	J. W. Restler	5	4	0	176
Surrey—					
Brixton (Acre Lane)	F. Gaster	8	1	0	77
Battersea (S. & V. Water Co.)	J. W. Restler	5	3	0	21

Daily Rainfall.

The 50 years (1841–90) mean at Greenwich for October is 2·81 in.

October, 1894.

Day of Mo.	Abinger	Dorking	Reigate Hill	Upper Gatton	Caterham	Marden Park	Westerham	Knockholt	Warling-ham	Coulsdon	Kenley
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	..	..	..	..	..	..	MONTHLY GAUGE.	..	..	..
2	..	..	..	..	..	..	..		..	..	..
3	..	..	..	..	..	..	..		..	..	..
4	·06	·09	·08	·10	·06	·05	..		·07	·08	·06
5	·10	·08	·08	·10	·01	·09	·13		·07	·11	·11
6	·03	·05	·02	·03	·03	·19	·18		·18	·09	·06
7	·02	..	·02	·01	..	..	·01		·03	..	..
8	..	..	·01	·02	..	..	..		..	..	·02
9	·03	·05	·06	·05	·05	·06	..		·07	·07	·06
10	·15	·21	·24	·28	·21	·17	·28		·25	·18	·19
11	..	..	..	..	..	..	..		·01	..	·01
12	..	..	..	..	..	..	..		..	..	..
13	·06	·07	·06	·08	·08	·06	·03		·07	·07	·06
14	·03	..	·01	·01	·01	·01	..		·02	..	·01
15	·05	·04	·03	·04	·03	·01	·06		..	..	·02
16	..	..	..	·01	..	..	..		..	..	..
17	..	..	..	..	..	..	..		..	..	..
18	..	..	·03	..	..	..	..		..	..	..
19	·08	·10	..	·02	..	·01	..		·05	·02	·02
20	·26	·26	·36	·42	·41	·35	·27		·37	·36	·34
21	·01	..	..	·01	..	..	..		..	..	..
22	·04	..	·01	·01	..	..	·02		..	..	·01
23	·02	·03	..	·02	·10	..	·03		..	·02	·02
24	1·21	1·26	·63	·55	·66	·51	·59		·53	·52	·59
25	·14	·15	·05	·08	·04	..	·14		·22	·12	·13
26	·88	·82	·49	·44	·47	·52	·27		·57	·46	·63
27	·23	·19	·19	·20	·15	·12	·08		·15	·16	·27
28	·34	·37	·19	·21	·10	·24	·11		·20	·24	·27
29	·26	·24	·21	·22	·33	·17	·33		·22	·22	·25
30	1·01	1·17	1·45	1·39	1·63	1·48	1·52		1·59	1·55	1·56
31	·07	·05	·05	·04	·03	..	·06		·04	·04	·03
*	5·08	5·23	4·27	4·34	4·40	4·04	4·11	5·00	4·71	4·31	4·72
†	....	29·85	28·32	30·65	29·12	24·21	26·98	27·12	30·53	26·84	28·81

Day of Mo.	Purley (Tudor C.)	Ashtead	Oxshott	Epsom	Banstead	Sutton	Wallington	Bedding-ton	Waddon	Croydon (Brim. Bn.)	Croydon (Wn.N.rd.)	Croydon Duppas H.	Croydon Chatfld. rd.	Croydon (Whitgift)	Croydon (Park Hill)
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
3	..	·01	..	·01	..	..	..	..	..	..	..	..	..	..	..
4	·05	·04	·03	·03	·03	·03	·02	·02	·03	·02	·03	·03	..	·04	·02
5	·26	·17	·17	·14	·15	·17	·17	·17	·15	·19	·20	·18	·05	·20	·16
6	·04	·02	·03	·05	·07	·17	·13	·11	·15	·10	·13	·15	·25	·13	·14
7	·02	·01	·01	..	..	·02	·01	..	..	..	·01	·01	..	..	..
8	..	·02	·01	·02	·01	·02	·01	·01	·01	..	·01	·01	·02	·02	·02
9	·09	·05	·05	·06	·04	·08	·07	·07	·07	·10	·08	·08	·05	·09	·09
10	·18	·17	·15	·22	·22	·19	·18	·19	·19	·20	·19	·20	·20	·20	·20
11	..	..	..	..	..	·01	..	..	·01	..	..	..	..	..	..
12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
13	..	·02	·05	·09	·05	·05	·04	·03	·03	·05	·02	·03	·02	·03	·03
14	·05	·04	·01	..	..	·01	..	..	..	..	·01	..	..	·01	..
15	·03	·03	·04	·02	·01	·02	·03	·01	·01	..	·02	·02	..	·02	·02
16	..	·01	..	·02	..	·01	..	..	..	..	..	·01	..	·01	..
17	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
18	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
19	·04	·01	·02	·02	·03	·02	·05	·05	·05	·03	·03	·04	·02	·03	·03
20	·33	·18	·16	·28	·33	·31	·32	·35	·34	·34	·34	·35	·33	·36	·33
21	..	..	..	..	..	·01	..	..	·01	..	..	..	..	..	..
22	..	·02	·03	·02	..	..	..	..	..	..	..	..	..	..	..
23	·02	·01	..	..	·01	·02	..	·01	·01	·02	·04	·01	..	..	..
24	·54	1·20	1·27	1·00	·71	·89	·64	·65	·67	·63	·52	·66	·52	·64	·64
25	·06	·10	·07	·08	·07	·11	·13	·11	·09	·11	·18	·10	·10	·09	·08
26	·76	·53	·54	·76	·80	·64	·69	·75	·81	·72	·80	·86	·72	·84	·87
27	·27	·47	·45	·21	·26	·23	·26	·33	·34	·31	·34	·34	·30	·36	·31
28	·26	·44	·37	·42	·41	·42	·40	·44	·39	·41	·36	·37	·40	·39	·37
29	·36	·28	·24	·27	·31	·30	·34	·34	·33	·33	·32	·33	·32	·32	·31
30	1·51	1·56	1·39	1·56	1·59	1·53	1·53	1·53	1·46	1·44	1·40	1·47	2·42	1·47	1·46
31	·03	·01	·02	·01	·02	·01	..	·01	·01	·02	·01	..	·01	·01	·01
*	4·90	5·40	5·11	5·29	5·12	5·27	5·02	5·18	5·16	5·02	5·04	5·25	5·73	5·26	5·09
†	28·32	25·26	24·11	26·53	26·87	25·37	25·23	25·06	24·35	25·37	23·63	25·40	24·74	25·75	25·13

* The figures in this row give the totals for the month.

† The totals from January 1st.

Daily Rainfall. *The 50 years (1841–90) mean at Greenwich for October is 2·81 in.* **October, 1894.**

Day of Mo.	Croydon (Outm.Rd.)	Addington Hills	Addington (Park Fm.)	Addington (Pump.St.)	W. Wickhm Wickhm.C.	W. Wickhm Layhms. F.	Hayes Common	Keston (Bradfield)	Keston (Tow. Fds.)	Orpington
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	..	..	..	..	..	..	..	..	..
2	..	..	..	..	..	..	..	..	..	..
3	..	..	..	..	..	..	..	..	..	..
4	·03	·06	·06	·05	·05	·04	·05	·06	·08	·06
5	·17	·17	·17	·18	·23	·19	·20	·20	·20	·23
6	·16	·16	·12	·08	·10	·12	·12	·11	·17	·09
7	·01	·01	..	·01	..	..	·01	·01	..	..
8	·01	·02	·04	·01	..	..	·02	·02	·01	..
9	·08	·09	·01	·08	·09	·10	·10	·06	·04	·09
10	·18	·24	·34	·25	·22	·22	·19	·20	·27	·25
11	..	..	..	..	..	..	..	·01	..	..
12	..	..	..	..	..	..	..	..	..	..
13	·02	·04	·03	·03	·02	·02	·02	·04	·02	·03
14	·01	·01	..	·01	..	..	..	..	..	·02
15	·02	·04	·01	·01	..	..	..	·01	·02	·03
16	..	·01	..	·01	..	..	..	·01	..	..
17	..	..	..	..	..	..	..	..	..	..
18	..	..	..	..	..	..	..	..	..	..
19	·03	·06	·06	·04	..	..	·05	·06	·06	·08
20	·31	·33	·34	·33	·42	·36	·29	·29	·29	·25
21	..	..	..	..	..	..	..	..	..	..
22	..	..	..	..	..	..	..	..	..	..
23	·01	·02	·01	..	·01	·02	·02	·02	·02	·02
24	·60	·56	·60	·70	·71	·67	·66	·58	·68	·70
25	·08	·07	·09	·11	·07	·18	·07	·10	·12	·20
26	·88	·72	·65	·48	·58	·42	·54	·42	·50	·40
27	·31	·32	·40	·38	·43	·36	·37	·28	·40	·30
28	·37	·29	·28	·25	·25	·20	·24	·20	·24	·23
29	·31	·39	·23	·22	·28	·24	·25	·20	·23	·22
30	1·39	1·52	1·55	1·52	1·73	1·54	1·39	1·60	1·73	1·37
31	·01	·02	·02	·03	·01	·03	·03	·02	·02	..
*	4·99	5·15	5·01	4·78	5·20	4·71	4·62	4·50	5·10	4·57
†	24·94	26·09	26·98	26·51	28·51	26·72	24·62	23·59	26·15	24·13

Day of Mo.	Farning-ham Hill	Wilming-ton	Bickley	Bromley	Bromley Common	Beckenham (Cedars rd.)	South Norwood	Thornton Heath	Wimbledon (Sew. Wks.)	Wimbledon (Mt. Ararat)	Raynes Park	New Malden	Esher	West Molesey	Surbiton	Kingston
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	..	..	..	..	..		..	..	..	..	..	..	..	..	..
2	..	..	..	..	..	..		..	..	..	..	..	..	..	..	..
3	·01	..	..	..	..	..		..	..	..	..	..	..	..	..	..
4	·04	·03	·03	·04	·04	·03		..	·02	..	·05	·02	·02	..	·02	·01
5	·25	·13	·20	·20	·16	·18		·23	·10	·14	·12	·09	·06	·10	·10	·10
6	·07	·08	·04	·05	·08	·06		..	·03	·03	·05	·15	·18	·21	·11	·03
7	·01	..	..	·02	·01	..		·01	..	·01	·02	·02	·03	·01	..	..
8	·01	..	·01	·02	·02	·01		..	·01	·01	·03	·01	·02	..	..	..
9	·08	..	·08	·07	·10	·09		·09	·10	·10	·13	·10	·07	·09	·09	·13
10	·33	·31	·29	·30	·25	·21		·16	·16	·16	·19	·19	·17	·20	·17	·23
11	..	·01	..	·01	·01	·01		..	..	..	..	..	..	·01	..	..
12	..	..	..	..	..	..		..	..	..	..	..	..	..	..	..
13	·05	·04	·03	·02	·03	·02		·03	·02	·07	·08	·04	·06	·06	·05	·04
14	·02	..	·01	·01	·02	..		..	..	..	..	..	..	..	..	..
15	·01	..	·01	·01	·01	·02		·01	·02	·02	·02	..	·02	·01	·02	·03
16	..	..	..	..	..	..		..	·02	·01	..	..	·01	..	..	·01
17	..	..	..	..	..	..	RECORD CEASED.	..	..	..	..	..	..	..	..	..
18	..	..	..	..	..	..		..	..	..	..	..	..	·02	..	..
19	·05	·02	·01	·02	·04	·02		..	..	..	·02	..	..	..	..	..
20	·27	·28	·27	·27	·29	·32		·33	·27	·25	·27	·20	·13	·15	·16	·20
21	..	..	..	..	·01	..		..	..	..	..	..	·01	..	..	..
22	..	..	..	..	..	..		..	..	..	..	..	..	..	..	..
23	·02	·01	·01	..	·01	·01		·01	·01	..	..	..	..	·01	..	..
24	·41	·30	·66	·60	·68	·40		·53	·86	·86	·89	·98	·70	·54	1·20	1·05
25	·09	·05	·07	·08	·07	·07		·08	·03	·03	·10	·02	·03	·04	·03	·02
26	·32	·23	85	·70	·53	·82		·68	·50	·46	·48	·45	·49	·49	·46	·62
27	·35	·35	·34	·33	·33	·38		·28	·30	·31	·36	·32	·29	·36	·34	·41
28	·20	·13	·19	·21	·20	·32		·34	·32	·31	·32	·36	·56	·41	·45	·53
29	·15	·19	·35	·33	·27	·26		·26	·23	·30	·25	·20	·22	·17	·21	·23
30	1·37	1·30	1 55	1·45	1·36	1·46		1·40	1·51	1·36	1·45	1·33	1·28	1·36	1·40	1·49
31	·01	..	·01	·02	·02	·01		..	·10	·01	·02	·01	·03	·01	..	·01
*	4·12	3·46	5·01	4·76	4·54	4·70		4·44	4·61	4·44	4·85	4·49	4·38	4·25	4·81	5·15
†	22·85	18·38	24·41	24·49	23·89	23·15		23·65	24·73	24·42	26·54	21·24	21·88	....	23·04	26·68

* The figures in this row give the totals for the month. † The totals from January 1st.

Daily Rainfall. *50 years (1841-90) mean for Greenwich for Oct. is 2·81 in.* **October, 1894.**

Day of Mo.	Richmond	Wandswth. Common	Streatham	West Norwood	Forest Hill Dartmh.rd.	Forest Hill (Nurseries)	Forest Hill S.&V.W.C.	Eltham	Woolwich	Greenwich	Deptford	Nunhead	Brixton	Battersea
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	..	..	..	..	..	..	..	..	..	..	..	..	..
2	..	..	..	..	..	..	..	..	..	..	..	..	..	..
3	..	..	..	..	..	..	..	..	..	..	..	..	..	..
4	·02	·02	·02	·03	·04	·05	·02	·03	·01	..	..	..	·02	·01
5	·10	·08	·13	·16	·17	·21	·15	·18	·08	·10	·08	·09	·10	·03
6	·08	·06	·04	·04	·06	·06	·04	·07	·01	·01	·02	·03	·07	·05
7	·01	·01	·01	·01	..	..	·01	·01	..	..	..	..	·01	..
8	..	·01	·01	·01	..	..	·01	·01	..	·01	..	..	..	..
9	·12	·09	·09	·09	·11	·02	·08	·07	·08	·06	·06	·06	·06	·07
10	·15	·19	·21	·22	·26	·34	·27	·34	·29	·27	·23	·19	·25	·21
11	..	..	·01	..	..	..	·01	..	..	..	..	..	..	..
12	..	..	..	..	..	..	..	..	..	..	..	..	..	..
13	·02	·03	·02	·02	·03	·02	·02	·06	·06	·05	·03	·01	·02	..
14	..	..	..	·01	..	·01	..	·02	·02	..	..	..	·01	·01
15	·03	·02	·03	·01	·03	·01	..	·03	·06	·02	·01	..	·04	·02
16	·03	..	..	..	..	..	..	..	..	..	..	..	..	..
17	..	..	..	..	..	..	..	..	..	..	..	..	..	..
18	·02	..	..	..	..	..	..	..	..	..	..	..	..	..
19	·01	·02	..	..	·01	..	·02	·01	..	..	..	·01	..	..
20	·18	·32	·33	·31	·33	·37	·36	·28	·32	·31	·31	·34	·34	·27
21	..	..	..	..	..	..	..	..	..	..	..	..	..	·01
22	..	..	..	..	..	..	..	·03	..	..	..	..	..	..
23	·01	·02	·02	..	·01	..	..	·01	·02	·01	..	..	..	..
24	·65	·73	·62	·65	·53	·41	·58	·38	·26	·39	·46	·54	·66	·78
25	·02	·04	·05	·06	·10	·15	·05	·13	·03	·03	·02	..	·02	·03
26	·55	·40	·53	·48	·48	·54	·56	·67	·40	·44	·47	·40	·41	·37
27	·23	·28	·27	·41	·42	·49	·45	·41	·36	·39	·29	·24	·29	·28
28	·44	·29	·35	·38	·34	·38	·33	·30	·32	·35	·35	·29	·38	·34
29	·21	·21	·21	·21	·23	·21	·21	·20	·15	·18	·18	·14	·18	·12
30	1·35	1·42	1·45	1·46	1·43	1·58	1·35	1·34	1·27	1·36	1·32	1·34	1·44	1·22
31	..	·02	·01	·01	·01	·02	·02	·02	..	·01	·01	·01	..	·01
*	4·23	4·26	4·41	4·57	4·59	4·87	4·54	4·60	3·74	3·99	3·84	3·69	4·30	3·83
†	24·23	23·07	....	23·57	22·74	22·74	21·80	22·71	21·56	21·93	19·97	18·66	23·45	18·76

* The figures in this row give the totals for the month. † The totals from January 1st.

Note.—The observations are taken at 9 a.m., except at Brixton and Addington Park Farm (8 a.m.), Bromley (8.30 a.m.), and Croydon (Waddon New Road) (10 a.m.).

NOTES.

(October, 1894.)

The month has been wet, warm, and unhealthy. There is an extensive outbreak of measles at Wallington, and the schools have been closed. No deaths, however, have occurred. It will be observed that at Greenwich the rainfall is rather over an inch above the average, and this probably represents the excess over the district. As is often the case, the greater part of the month's rainfall fell at the end of the month. There have been extensive floods in several parts of the district. On the 24th, at Mt. Ararat, Wimbledon, ·76 in. fell in three hours. The mean temperature at Waddon was 50·2°, at Wallington 50·1°, and at Croydon (Duppas House) 50°, and is about 1° above the average. There were recorded at Woolwich 42¾ hours of bright sunshine, and at Wallington 54·2 hours of sunlight, which latter amount is 18 per cent. below the average.

Francis Campbell Bayard, F.R.Met. Soc.,

Hon. Sec.

CROYDON MICROSCOPICAL AND NATURAL HISTORY CLUB *(Meteorological Subcommittee).*

Stations.	Observers.	Size of Gauge.	Height above Ground.		Height of Statn. ab. Sea-level.
		IN.	FT.	IN.	FT.
SURREY—					
Abinger (The Rectory)	Miss Brodie-Hall	5	1	0	381
Dorking (Denbies)	J. Beesley	5	0	6	610
Reigate Hill (Margery Hall)	W. F. Taylor	5	2	0	756
Upper Gatton	F. Druce	5	1	0	600
Caterham (Metropol. Asylum)	G. S. Elliott, M.D.	5	1	0	610
Marden Park (Birchwood House)	Mrs. F. Rutley	5	1	0	471
KENT—					
Westerham (The Fishponds)	W. Morris	5	1	0	380
Knockholt (The Beeches)	W. Morris	5	1	0	785
SURREY—					
Warlingham (The Vicarage)	Rev. F. R. Marriott	5	1	0	614
Coulsdon (The Grange)	W. J. Stride	5	1	4	525
Kenley (Ingleside)	H. Smith	8	1	0	375
Purley (Tudor Cottages)	J. Bonwick	5	1	0	216
Ashtead (D'Abernon Chase)	Sir W. Vincent, Bart.	5	1	0	280
Oxshott	W. H. Dines	5	1	0	212
Epsom (Epsom College)	C. J. Gardiner	8	1	0	290
Banstead (The Larches)	Rev. C. J. Taylor	8	1	0	488
Sutton (Mulgrave Road)	W. Goode	5	5	6	230
Wallington (Maldon Road)	F. C. Bayard	5	4	1	140
Beddington (Riverside)	S. Rostron	5	1	0	120
Waddon (Waddon House)	P. Crowley	5	1	0	156
Croydon (Brimstone Barn)	Croydon Corporation	5	1	0	130
Croydon (Waddon New Road)	Croydon Corporation	5	1	0	146
Croydon (Duppas House)	Baldwin Latham	8	1	0	158
Croydon (Chatfield Road)	A. Malden	5	1	0	166
Croydon (Whitgift School)	A. E. Watson	5	1	0	191
Croydon (Park Hill Rise)	H. F. Parsons, M.D.	5	1	0	250
Croydon (Outram Road)	E. Mawley	8	0	9	202
Addington Hills (The Reservoir)	Croydon Corporation	8	0	9	473
Addington (Park Farm)	W. Whalley	5	1	0	268
Addington (Pumping Station)	Croydon Corporation	8	1	0	331
KENT—					
West Wickham (Wickham Ct.)	Sir J. F. Lennard, Bart.	5	1	2	300
West Wickham (Layham's Fm.)	W. Ashcroft	5	1	0	500
Hayes Common (The Warren)	Miss Akers	5	1	0	296

Stations.	Observers.	Size of Gauge.	Height above Ground.		Height of Statn. ab. Sea-level.
		IN.	FT.	IN.	FT.
KENT—					
Keston (Bradfield)	A. Hill	5	1	0	350
Keston (Tower Fields)	G. Buchanan	8	0	9	351
Orpington (Kent Water Co.)	W. Morris	5	1	0	220
Farningham Hill	A. J. Waring	5	3	0	300
Wilmington (Kent Water Co.)	W. Morris	5	1	0	25
Bickley (Highfield)	J. Batten	5	1	2	295
Bromley (Sundridge Avenue)	J. B. Snell	5	1	0	245
Bromley Common (Elmfield)	Rev. J. P. Faunthorpe	5	0	9	240
Beckenham (Cedars Road)	H. Dolling Smith	5	1	0	105
SURREY—					
South Norwood (Apsley Road)	W. H. Cullis	5	1	0	125
Thornton Heath (Thornton Rd.)	A. Wright	8	0	10	120
Wimbledon (Sewage Works)	C. H. Cooper	5	1	0	58
Wimbledon (Mount Ararat)	T. Devas	12	3	0	157
Raynes Park (Pumping Station)	C. H. Cooper	5	1	0	47
New Malden (Sewage Works)	T. V. H. Davison	5	1	0	45
Esher (Sewage Works)	W. H. Hope	5	1	0	40
West Molesey (Chelsea W. Co.)	R. Hack	5	1	0	32
Surbiton (Seething Wells)	R. Hack	10	0	6	25
Kingston (Sewage Works)	T. Stevens	5	1	0	25
Richmond (Ormond Lodge)	J. T. Billett	5	0	9	51
Wandsworth Com. (Patten Rd.)	F. J. Brodie	5	1	0	100
Streatham (Woodfield Avenue)	F. Jordan	5	1	0	120
West Norwood (Thornlaw Road)	W. Marriott	8	1	0	220
KENT—					
Forest Hill (Dartmouth Road)	Mrs. Behrens	5	1	0	220
Forest Hill (The Nurseries)	James Carter & Co.	6	0	6	76
Forest Hill (S. & V. Water Co.)	J. W. Restler	5	1	0	344
Eltham (High Street)	W. Morris	5	1	0	245
Woolwich (Powis Street)	J. G. Waller	5	30	0	65
Greenwich (Royal Observatory)	Astronomer Royal	8	0	5	155
Deptford (Kent Water Co.)	W. Morris	5	1	0	20
Nunhead (S. & V. Water Co.)	J. W. Restler	5	4	0	176
SURREY—					
Brixton (Acre Lane)	F. Gaster	8	1	0	77
Battersea (S. & V. Water Co.)	J. W. Restler	5	3	0	21

Daily Rainfall. *The 50 years (1841–90) mean at Greenwich for November is 2·27 in.* **November, 1894.**

Day of Mo.	Abinger	Dorking	Reigate Hill	Upper Gatton	Caterham	Marden Park	Westerham	Knockholt	Warling-ham	Coulsdon	Kenley
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·15	·13	·19	·18	·19	·20	·23	MONTHLY GAUGE.	·19	·14	·14
2	·07	·05	·04	·04	·04	..	·07		·02	·03	·03
3	·26	·22	·08	·06	·07	·16	·16		·12	·05	·05
4	..	..	·01	..	..	..	..		..	..	·01
5	·07	·09	·08	·12	·16	·16	..		·10	·09	·09
6	·05	·03	·02	·01	·02	·01	·05		·03	·02	·02
7	·42	·52	·43	·42	·60	·55	·65		·56	·53	·60
8	·08	·02	·06	·01	·02	..	..		·01	·01	·03
9	·23	·18	·17	·15	·16	·12	·13		·14	·14	·14
10	·17	·16	·13	·13	·10	·12	·23		·15	·17	·26
11	·65	·57	·62	·58	·75	·64	·70		·63	·54	·49
12	·86	·83	1·08	1·03	1·27	1·20	·79		1·25	1·14	1·21
13	·56	·50	·21	·20	·20	·11	·08		·14	·18	·25
14	1·13	1·00	1·22	·99	1·29	·71	1·00		1·09	1·18	1·18
15	·21	·20	·10	·12	·12	·12	·45		·08	·12	·12
16	·41	·27	·25	·25	·22	·19	·05		·21	·20	·18
17	·03	·07	·03	·03	..	..	·02		·02	·02	·03
18	..	..	·02	·02	·05	..	..		·02	·01	·01
19	..	·02	·01	·01	·01	..	..		..	..	·01
20	·13	·11	·10	·10	·10	·10	·08		·08	·08	·08
21	..	..	·01	·01	..	..	..		..	..	·01
22	..	..	·01	..	..	..	..		..	..	·01
23	..	..	·01	·02	..	..	..		..	..	..
24	..	..	·01	..	..	..	..		..	..	..
25	..	..	..	..	..	..	..		..	..	..
26	..	..	..	..	..	..	..		..	..	..
27	..	..	..	..	..	..	..		..	..	..
28	·03	..	..	..	..	..	..		..	..	..
29	..	..	·01	·01	..	..	..		·02	..	..
30	..	·02	·01	·01	..	..	..		..	..	..
*	5·51	4·99	4·91	4·50	5·37	4·39	4·69	4·25	4·86	4·65	4·95
†	....	34·84	33·23	35·15	34·49	28·60	31·67	31·37	35·39	31·49	33·76

Day of Mo.	Purley (Tudor C.)	Ashtead	Oxshott	Epsom	Banstead	Sutton	Wallington	Bedding-ton	Waddon	Croydon (Brim. Bn.)	Croydon (Wn.N.rd.)	Croydon Duppas H.	Croydon Chatfld. rd.	Croydon (Whitgift)	Croydon (Park Hill)
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·11	·10	·09	·11	·12	·08	·09	·12	·11	·11	·11	·13	·10	·12	·12
2	·06	·02	·01	·02	·03	·01	·01	·02	·01	·02	·01	·01	..	·02	·01
3	·04	·29	·13	·21	·20	·26	·23	·15	·08	·14	·07	·07	·09	·07	·06
4	·02	..	..	..	..	·01	..	..	..	..	..	..	..	..	..
5	·45	·21	·10	·09	·12	·10	·09	·09	·09	·11	·10	·10	·09	·11	·09
6	·02	·01	·01	·05	·08	·07	·04	·03	·03	·04	·03	·04	·02	·04	·03
7	·57	·43	·37	·45	·49	·47	·48	·50	·49	·53	·48	·51	·49	·55	·52
8	·03	·01	·01	·04	·02	·02	..	..	..	..	..	..	..	..	..
9	·13	·15	·15	·17	·16	·11	·09	·09	·09	·10	·08	·09	·08	·09	·08
10	·25	·24	·22	·30	·42	·22	·22	·21	·25	·21	·22	·24	·19	·23	·33
11	·50	·38	·33	·42	·48	·39	·37	·40	·39	·34	·36	·40	·32	·40	·39
12	1·12	·66	·56	·74	·93	·82	1·01	1·05	·99	·98	1·00	1·02	1·03	1·00	·93
13	·15	·35	·27	·21	·31	·22	·22	·22	·17	·15	·18	·21	·14	·13	·19
14	·96	·87	·75	·89	1·23	1·04	1·11	1·06	1·04	·88	1·04	1·09	1·01	1·06	1·08
15	·13	·11	·09	·10	·13	·10	·13	·14	·11	·12	·13	·11	·11	·11	·10
16	·18	·08	·03	·12	·18	·11	·13	·15	·14	·14	·14	·15	·12	·14	·15
17	..	·03	·04	·04	·03	·03	·02	·02	·02	·02	·02	·02	·01	·03	·02
18	..	·01	..	·01	·01	·01	..	..	·01	..	..	..	..	·02	·01
19	..	·01	·02	..	·01	..	..	..	·01	..	·01	·01	..	..	..
20	·07	·10	·10	·10	·09	·11	·09	·09	·08	·09	·08	·08	·07	·08	·08
21	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	·01
22	..	·01	·01	..	..	..	..	..	·01	..	..	·01	..	..	..
23	..	..	..	·02	..	..	..	..	..	..	..	..	..	..	·01
24	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	..
25	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..
26	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	..
27	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
28	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
29	..	..	..	·01	..	..	..	..	..	..	·01	..	..	..	..
30	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
*	4·79	4·09	3·29	4·10	5·04	4·18	4·33	4·34	4·13	3·98	4·07	4·30	3·87	4·20	4·11
†	33·11	29·35	27·40	30·63	31·91	29·55	29·56	29·40	28·48	29·35	27·70	29·70	28·61	29·95	29·24

* The figures in this row give the totals for the month. † The totals from January 1st.

Daily Rainfall. *The 50 years (1841–90) mean at Greenwich for November is 2·27 in.* **November, 1894.**

Day of Mo.	Croydon (Outm.Rd.)	Addington Hills	Addington (Park Fm.)	Addington (Pump.St.)	W.Wickhm Wickhm.C.	W.Wickhm Layhms.F.	Hayes Common	Keston (Bradfield)	Keston (Tow. Fds.)	Orpington	Farning-ham Hill	Wilming-ton	Bickley
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·12	·13	·16	·17	·16	·18	·14	·15	·18	·17	·13	·10	·09
2	·01	·02	·02	·02	·01	·02	·02	·02	·02	·02	·02	..	..
3	·04	·05	·04	·02	·05	·15	·05	·11	·13	·11	·13	·12	·02
4	..	..	..	..	..	..	..	..	..	..	..	..	..
5	·10	·13	·19	·11	·19	·10	·15	·12	·15	·13	·09	·11	·09
6	·02	·02	·01	·01	..	..	·02	·02	·02	·02	·01	..	..
7	·51	·50	·54	·54	·64	·56	·58	·52	·59	·57	·48	·35	·51
8	..	..	..	..	..	..	..	..	..	..	..	..	..
9	·08	·12	·11	·11	·10	·13	·09	·10	·10	·09	·07	·05	·05
10	·22	·30	·42	·44	·44	·30	·32	·35	·34	·36	·26	·20	·20
11	·39	·45	·41	·51	·52	·45	·43	·50	·45	·58	·57	·45	·40
12	·87	1·00	1·20	1·14	1·39	1·30	1·25	1·23	1·23	·88	·82	·75	1·20
13	·20	·19	·14	·18	·14	·10	·12	·07	·11	·11	·10	·05	·08
14	1·09	1·02	·98	1·10	1·20	·85	1·15	·93	1·06	1·12	1·02	·85	1·08
15	·13	·12	·34	·14	·16	·22	·15	·19	·33	·20	·26	·25	·15
16	·13	·17	·23	·25	·21	·12	·16	·09	·11	·06	·04	·03	·13
17	·02	·03	..	·03	·03	·03	·03	·02	·03	·02	·01	..	·02
18	·01	·02	..	·01	·01	·02	·02	·01	..	..	·02	..	..
19	..	..	..	..	..	..	..	·01	·02	..	·01	..	..
20	·08	·07	·09	·07	·08	·08	·07	·05	·05	·05	·04	·06	·07
21	..	..	..	·01	..	·02	·01	·01	..	..	·01	..	..
22	..	..	..	..	..	..	..	..	..	..	·01	..	..
23	..	·01	..	..	..	·01	..	..	..	..	·01	..	..
24	..	..	..	..	..	..	..	..	..	..	..	..	..
25	..	..	..	..	..	..	..	..	..	..	..	..	..
26	..	..	·01	..	..	..	..	..	..	..	..	..	..
27	..	..	..	..	..	..	..	..	..	..	..	..	..
28	..	..	..	..	·01	..	..	..	..	..	..	..	..
29	..	..	..	..	·01	..	..	..	..	..	..	..	..
30	..	..	..	..	..	..	..	..	..	..	..	..	..
*	4·02	4·35	4·89	4·86	5·35	4·64	4·76	4·50	4·92	4·49	4·11	3·37	4·09
†	28·96	30·44	31·87	31·37	33·86	31·36	29·38	28·09	31·07	28·62	26·96	21·75	28·50

Day of Mo.	Bromley	Bromley Common	Beckenham (Cedars rd.)	South Norwood	Thornton Heath	Wimbledon (Sew. Wks.)	Wimbledon (Mt. Ararat)	Raynes Park	New Malden	Esher	West Molesey	Surbiton	Kingston
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·11	·13	·10	·09	·10	·08	·08	·11	·06	·06	·06	·10	·11
2	·01	·01	·01	·01	..	·01	·01	·04	..	·03	·05	..	·01
3	·03	·04	·03	·06	·18	·23	·23	·26	·12	·10	·08	·09	·10
4	..	·01	..	..	..	..	..	..	..	·03	..	..	..
5	·12	·12	·08	·08	·09	·03	·04	·05	·02	·04	·02	·02	·04
6	·01	·01	·02	·45	·05	·01	·01	·03	·01	·01	..	..	·01
7	·48	·51	·42	·05	·52	·46	·50	·55	·44	·39	·50	·43	·58
8	·01	..	..	..	..	..	..	·02	..	·03	·02	·01	..
9	·06	·07	·07	·07	·08	·10	·10	·12	·09	·10	·10	·10	·10
10	·22	·22	·22	·30	·18	·15	·15	·18	·10	·16	·12	·14	·15
11	·37	·39	·36	·30	·32	·32	·33	·34	·28	·28	·39	·38	·42
12	1·24	1·14	·97	·89	1·00	·62	·65	·68	·47	·42	·69	·48	·68
13	·10	·10	·11	·32	·15	·12	·14	·18	·10	·08	·18	·18	·20
14	1·06	·91	·98	·87	·92	·47	·64	·73	·59	·39	·64	·67	·72
15	·17	·17	·12	·26	·10	·10	·13	·13	·11	·13	·12	·13	·14
16	·14	·14	·09	·09	·09	·04	·03	·07	..	·03	·03	..	·02
17	·02	..	·02	..	·02	·01	·03	·04	·03	·03	·04	..	..
18	..	..	..	·02	..	..	·01	..	..	..	..	·04	..
19	..	·03	..	..	·01	..	..	·03	..	·02	..	..	..
20	·08	·06	·08	·06	·06	·08	·08	·12	·05	·04	·06	·06	·08
21	..	..	..	..	·02	..	..	..	..	..	..	..	..
22	..	..	..	..	..	..	·02	..	..	..	..	..	..
23	..	..	..	..	..	..	..	..	..	..	..	..	..
24	·01	..	..	..	..	..	..	·03	..	..	..	..	..
25	..	..	..	..	..	..	..	..	..	..	..	..	..
26	..	..	..	·01	..	..	..	..	..	..	..	..	..
27	..	..	..	..	..	..	..	..	..	..	..	..	..
28	..	..	..	..	..	..	..	..	..	..	..	..	..
29	..	..	..	..	..	..	..	..	..	..	..	..	..
30	..	..	..	..	..	..	..	..	..	..	..	..	..
*	4·24	4·06	3·68	3·93	3·89	2·83	3·18	3·71	2·47	2·37	3·10	2·83	3·36
†	28·73	27·95	26·83	....	27·54	27·56	27·60	30·25	23·71	24·25	....	25·87	30·04

* The figures in this row give the totals for the month. † The totals from January 1st.

Daily Rainfall. *50 years (1841-90) mean for Greenwich for Nov. is 2·27 in.* **November, 1894.**

Day of Mo.	Richmond	Wandswth. Common	Streatham	West Norwood	Forest Hill Dartmh.rd.	Forest Hill (Nurseries)	Forest Hill S.&V.W.C.	Eltham	Woolwich	Greenwich	Deptford	Nunhead	Brixton	Battersea
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·08	·09	·09	·10	·01	·07	·10	·09	·09	·09	·08	·07	·09	·06
2	·04	·02	·02	..	·02	·05	·01	..	·01	·01	·01	..	·01	..
3	·13	·21	·24	·15	·15	·14	·13	·03	·08	·12	·11	·12	·20	·22
4	..	·01	..	..	..	..	..	..	..	..	..	..	..	..
5	·02	·05	·03	·05	·04	·06	·04	·03	·02	·02	·01	..	·04	·02
6	·01	·03	·03	·06	·07	·06	·07	·02	·06	·05	·05	·07	·02	·01
7	·51	·43	·48	·44	·43	·45	·44	·38	·30	·39	·37	·37	·44	·35
8	..	·01	..	..	..	..	..	..	..	..	..	..	..	..
9	·10	·10	·09	·09	·17	·10	·09	·07	·05	·06	·05	·06	·09	·06
10	·13	·14	·13	·14	·05	·17	·15	·12	·11	·11	·11	·11	·12	·10
11	·40	·32	·29	·29	·39	·29	·27	·32	·28	·30	·26	·30	·29	·33
12	·49	·65	·87	·85	·74	·92	·75	1·03	·90	·80	·77	·73	·73	·60
13	·16	·11	·10	·10	·09	·10	·08	·03	·02	·04	·04	·02	·10	·07
14	·58	·71	·83	·93	·77	·82	·70	·87	·73	·75	·71	·70	·88	·53
15	·15	·12	·08	·08	·08	·26	·10	·15	·15	·10	·09	·06	·13	·11
16	·02	·04	·08	·06	·06	·02	·05	·14	·05	·04	·04	·04	·04	·01
17	·04	·01	·02	·01	·02	·01	·01	·02	..	·01	·01	·01	..	..
18	·01	·01	..	·01	..	..	·01	..	..	..	..	..	..	..
19	·01	·01	..	·01	..	..	..	..	..	..	..	·01	..	..
20	·07	·08	·09	·10	·11	·13	·11	·09	·10	·11	·08	·07	·09	·06
21	·01	..	..	..	..	·02	..	·01	..	..	..	..	..	..
22	..	..	..	..	..	..	..	..	..	..	..	..	..	..
23	..	..	..	·01	..	..	·01	..	..	..	..	..	..	..
24	·01	..	..	..	..	·02	..	..	..	..	..	..	..	..
25	..	..	..	..	..	..	..	..	..	..	..	..	..	..
26	..	..	..	..	..	..	..	..	..	..	..	..	..	..
27	..	..	..	..	..	..	..	..	..	..	..	..	..	..
28	..	..	..	..	..	..	..	..	..	..	..	..	..	..
29	..	..	..	..	..	·01	..	..	..	..	..	..	..	..
30	..	..	..	..	..	..	..	..	..	..	..	..	..	..
*	2·97	3·15	3·47	3·48	3·20	3·70	3·12	3·40	2·95	3·00	2·79	2·74	3·27	2·53
†	27·20	26·22	....	27·05	25·94	26·44	24·92	26·11	24·51	24·93	22·76	21·40	26·72	21·29

* The figures in this row give the totals for the month. † The totals from January 1st.

Note.—The observations are taken at 9 a.m., except at Brixton and Addington Park Farm (8 a.m.), Bromley (8.30 a.m.), and Croydon (Waddon New Road) (10 a.m.).

NOTES.

(November, 1894.)

The month may practically be divided; the first half being wet, warm, and sunny, whilst the latter half was dry and cool. The weather at the beginning of the month was a continuance of that at the end of October, and to show this, the example of Kenley may be cited, when in 24 days, from 24th October to 16th November, 8·53 in. of rain fell. The month has been mild, and many flowers were in bloom at the end of it, including wallflowers at Wallington. A severe thunderstorm occurred on the afternoon of the 12th at most places in the district. A solar halo was seen at Croydon on the 22nd. The mean temperature at Wallington was 46·6°, at Croydon (Duppas House) 46·4°, and at Waddon 45·9°, and is about 3° above the average. There were recorded at Woolwich 59¼ hours of bright sunshine, and at Wallington 89·2 hours of sunlight, which latter is 14 per cent. above the average.

Francis Campbell Bayard, F.R.Met. Soc.,

Hon. Sec.

CROYDON MICROSCOPICAL AND NATURAL HISTORY CLUB *(Meteorological Subcommittee).*

Stations.	Observers.	Size of Gauge.	Height above Ground.		Height of Statn. ab. Sea-level.
		IN.	FT.	IN.	FT.
SURREY—					
Abinger (The Rectory)	Miss Brodie-Hall	5	1	0	381
Dorking (Denbies)	J. Beesley	5	0	6	610
Reigate Hill (Margery Hall)	W. F. Taylor	5	2	0	756
Upper Gatton	F. Druce	5	1	0	600
Caterham (Metropol. Asylum)	G. S. Elliott, M.D.	5	1	0	610
Marden Park (Birchwood House)	Mrs. F. Rutley	5	1	0	471
KENT—					
Westerham (The Fishponds)	W. Morris	5	1	0	380
Knockholt (The Beeches)	W. Morris	5	1	0	785
SURREY—					
Warlingham (The Vicarage)	Rev. F. R. Marriott	5	1	0	614
Coulsdon (The Grange)	W. J. Stride	5	1	4	525
Kenley (Ingleside)	H. Smith	8	1	0	375
Purley (Tudor Cottages)	J. Bonwick	5	1	0	216
Ashtead (D'Abernon Chase)	Sir W. Vincent, Bart.	5	1	0	280
Oxshott	W. H. Dines	5	1	0	212
Epsom (Epsom College)	C. J. Gardiner	8	1	0	290
Banstead (The Larches)	Rev. C. J. Taylor	8	1	0	488
Sutton (Mulgrave Road)	W. Goode	5	5	6	230
Wallington (Maldon Road)	F. C. Bayard	5	4	1	140
Beddington (Riverside)	S. Rostron	5	1	0	120
Waddon (Waddon House)	P. Crowley	5	1	0	156
Croydon (Brimstone Barn)	Croydon Corporation	5	1	0	130
Croydon (Waddon New Road)	Croydon Corporation	5	1	0	146
Croydon (Duppas House)	Baldwin Latham	8	1	0	158
Croydon (Chatfield Road)	A. Malden	5	1	0	166
Croydon (Whitgift School)	A. E. Watson	5	1	0	191
Croydon (Park Hill Rise)	H. F. Parsons, M.D.	5	1	0	250
Croydon (Outram Road)	E. Mawley	8	0	9	202
Addington Hills (The Reservoir)	Croydon Corporation	8	0	9	473
Addington (Park Farm)	W. Whalley	5	1	0	268
Addington (Pumping Station)	Croydon Corporation	8	1	0	331
KENT—					
West Wickham (Wickham Ct.)	Sir J. F. Lennard, Bart.	5	1	2	300
West Wickham (Layham's Fm.)	W. Ashcroft	5	1	0	500
Hayes Common (The Warren)	Miss Akers	5	1	0	296

Stations.	Observers.	Size of Gauge.	Height above Ground.		Height of Statn. ab. Sea-level.
		IN.	FT.	IN.	FT.
KENT—					
Keston (Bradfield)	A. Hill	5	1	0	350
Keston (Tower Fields)	G. Buchanan	8	0	9	351
Orpington (Kent Water Co.)	W. Morris	5	1	0	220
Farningham Hill	A. J. Waring	5	3	0	300
Wilmington (Kent Water Co.)	W. Morris	5	1	0	25
Bickley (Highfield)	J. Batten	5	1	2	295
Bromley (Sundridge Avenue)	J. B. Snell	5	1	0	245
Bromley Common (Elmfield)	Rev. J. P. Faunthorpe	5	0	9	240
Beckenham (Cedars Road)	H. Dolling Smith	5	1	0	105
SURREY—					
South Norwood (Apsley Road)	W. H. Cullis	5	1	0	125
Thornton Heath (Thornton Rd.)	A. Wright	8	0	10	120
Wimbledon (Sewage Works)	C. H. Cooper	5	1	0	58
Wimbledon (Mount Ararat)	T. Devas	12	3	0	157
Raynes Park (Pumping Station)	C. H. Cooper	5	1	0	47
New Malden (Sewage Works)	T. V. H. Davison	5	1	0	45
Esher (Sewage Works)	W. H. Hope	5	1	0	40
West Molesey (Chelsea W. Co.)	R. Hack	5	1	0	32
Surbiton (Seething Wells)	R. Hack	10	0	6	25
Kingston (Sewage Works)	T. Stevens	5	1	0	25
Richmond (Ormond Lodge)	J. T. Billett	5	0	9	51
Wandsworth Com. (Patten Rd.)	F. J. Brodie	5	1	0	100
Streatham (Woodfield Avenue)	F. Jordan	5	1	0	120
West Norwood (Thornlaw Road)	W. Marriott	8	1	0	220
KENT—					
Forest Hill (Dartmouth Road)	Mrs. Behrens	5	1	0	220
Forest Hill (The Nurseries)	James Carter & Co.	6	0	6	76
Forest Hill (S. & V. Water Co.)	J. W. Restler	5	1	0	344
Eltham (High Street)	W. Morris	5	1	0	245
Woolwich (Powis Street)	J. G. Waller	5	30	0	65
Greenwich (Royal Observatory)	Astronomer Royal	8	0	5	155
Deptford (Kent Water Co.)	W. Morris	5	1	0	20
Nunhead (S. & V. Water Co.)	J. W. Restler	5	4	0	176
SURREY—					
Brixton (Acre Lane)	F. Gaster	8	1	0	77
Battersea (S. & V. Water Co.)	J. W. Restler	5	3	0	21

Daily Rainfall. *The 50 years (1841–90) mean at Greenwich for December is 1·77 in.* **December, 1894.**

Day of Mo.	Abinger	Dorking	Reigate Hill	Upper Gatton	Caterham	Marden Park	Westerham	Knockholt	Warling-ham	Coulsdon	Kenley	Purley (Tudor C.)
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	..	..	·01	..	..	..		..	..	..	..
2	..	..	·01	..	..	..	..		..	..	..	..
3	..	..	·01	..	..	..	..		..	..	..	..
4	·03	·04	·05	·06	·04	..	..		·03	·03	·03	..
5	..	..	·01	..	..	..	..		..	..	..	..
6	·06	·04	·05	·05	·04	·06	·04		..	·03	·03	·05
7	·25	·28	·25	·31	·08	·32	·39		·35	·27	·26	·22
8	..	·02	·02	·02	..	..	·01		·02	..	·01	..
9	..	..	..	..	..	..	..		..	..	..	..
10	..	..	..	..	·01	·01	..		·02	..	..	·03
11	·25	·21	·12	·13	·09	·10	·12		·09	·09	·08	·03
12	..	..	..	·02	·01	..	..		·01	..	·01	·04
13	·04	·02	·03	·03	·06	·02	..		·05	·03	·03	·05
14	·75	·85	·70	·73	·80	·68	·61		·72	·47	·61	·47
15	·15	·20	·22	·24	·23	·19	·18		·18	·21	·18	·15
16	·02	..	·04	·02	·03	·02	..	MONTHLY GAUGE.	·03	..	·01	·01
17	·08	·07	·06	·06	·09	·04	·01		·06	·06	·04	·03
18	·21	·15	·27	·16	·23	·06	·23		·23	·14	·16	·13
19	·02	..	·01	·01	..	·04	·02		..	·01	..	..
20	·01	..	·02	·01	..	·07	..		·01	..	..	..
21	·40	·37	·34	·35	·38	·26	·05		·36	·21	·31	·19
22	..	..	..	..	..	..	..		..	..	..	..
23	·15	·12	·14	·15	·21	·15	·03		·20	·14	·14	·10
24	·06	·04	·04	·05	·07	·05	·12		·06	·06	·05	·11
25	..	..	·01	..	·01	·02	·03		..	..	..	·02
26	·11	·10	·10	·11	·11	·08	·09		·12	·10	·10	·10
27	..	..	·02	..	..	·01	..		..	..	..	·03
28	·05	·03	·02	·03	..	·01	..		·04	·02	·02	..
29	·02	..	·01	..	..	..	..		..	..	..	..
30	..	..	..	..	..	..	..		..	..	..	..
31	..	..	..	..	..	..	..		..	..	..	..
*	2·69	2·54	2·55	2·55	2·49	2·19	1·93	2·70	2·58	1·87	2·07	1·76
†	....	37·38	35·78	37·70	36·98	30·79	33·60	34·07	37·97	33·36	35·83	34·87

Day of Mo.	Ashtead	Oxshott	Epsom	Banstead	Sutton	Wallington	Bedding-ton	Waddon	Croydon (Brim. Bn.)	Croydon (Wn.N.rd.)	Croydon Duppas H.	Croydon Chatfld. rd.	Croydon (Whitgift)	Croydon (Park Hill)
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	·01	..	·01	..	..	·01	..	..	..	..	·01	..	·01	·01
2	..	..	..	..	..	..	·01	·01	..	..	..	..	..	..
3	..	..	..	..	..	..	..	..	..	..	..	..	..	..
4	·02	·02	·03	·06	·04	·01	..	..	..	·01	·01	..	..	..
5	..	..	..	..	..	..	..	..	..	..	..	..	..	..
6	·01	·03	·02	·03	·01	·02	·01	·02	..	·01	·01	·01	·02	·01
7	·12	·12	·18	·21	·16	·16	·17	·19	·19	·16	·19	·15	·18	·18
8	·01	·01	·01	..	..	·01	..	..	..	·01	..	..	·01	..
9	..	..	..	..	·01	..	..	·01	..	..	..	..	..	..
10	..	..	·01	..	..	..	..	..	..	..	·01	..	·01	..
11	·15	·13	·12	·09	·10	·07	·08	·07	·06	·06	·06	·07	·07	·06
12	..	..	..	..	..	..	..	·01	..	..	·01	..	·01	..
13	..	·01	..	..	..	..	..	..	..	·01	..	..	·01	..
14	·80	·78	·70	·65	·73	·64	·67	·62	·66	·58	·63	·65	·63	·66
15	·18	·17	·19	·19	·15	·17	·18	·17	·18	·16	·17	·11	·18	·16
16	·01	·01	·01	..	..	..	..	..	..	..	·01	..	..	..
17	·01	·01	·02	·03	·02	·01	·02	·02	·03	·01	·02	·01	·02	·02
18	·10	·07	·11	·12	·10	·11	·11	·10	·18	·10	·10	·09	·10	·12
19	·01	..	·01	..	..	..	..	..	..	..	..	·01	·01	·03
20	..	..	..	..	..	..	..	..	..	·01	..	..	..	..
21	·23	·20	·24	·27	·22	·19	·22	·19	·22	·18	·19	·19	·21	·22
22	..	..	..	..	..	..	..	..	..	..	..	..	..	..
23	·07	·07	·09	·13	·09	·07	·09	·08	·09	·08	·08	·07	·08	·08
24	·02	·04	..	·04	·03	·02	·04	·03	·05	·04	·04	·04	·04	·05
25	·03	..	..	..	..	..	..	..	..	..	·01	..	..	..
26	·10	·12	·11	·12	·12	·11	·11	·11	·11	·10	·11	·10	·11	·10
27	·01	..	..	..	..	..	..	..	..	..	..	..	..	..
28	·02	·03	·03	·03	·02	·02	·04	·03	·05	·04	·05	..	·04	·07
29	..	..	..	..	..	..	..	..	..	·01	..	..	..	..
30	..	..	..	..	..	..	..	..	..	..	..	..	..	..
31	..	..	..	..	..	..	..	..	..	..	..	..	..	..
*	1·91	1·82	1·89	1·97	1·80	1·62	1·75	1·66	1·82	1·57	1·71	1·50	1·74	1·77
†	31·26	29·22	32·52	33·88	31·35	31·18	31·15	30·14	31·17	29·27	31·41	30·11	31·69	31·01

* The figures in this row give the totals for the month. † The totals from January 1st.

Daily Rainfall. *The 50 years (1841–90) mean at Greenwich for December is 1·77 in.* **December, 1894.**

Day of Mo.	Croydon (Outm.Rd.)	Addington Hills	Addington (Park Fm.)	Addington (Pump.St.)	W.Wickhm Wickhm.C.	W.Wickhm Layhms.F.	Hayes Common	Keston (Bradfield)	Keston (Tow. Fds.)	Orpington	Farning-ham Hill	Wilming-ton	Bickley	Bromley	Bromley Common	Beckenham (Cedarsrd.)	South Norwood	Thornton Heath	Wimbledon (Sew. Wks.)	Wimbledon (Mt.Ararat)	Raynes Park	New Malden	Esher	West Molesey	Surbiton	Kingston
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	·01	..	..	..	..	..	..	·02	..	·01	..	..	·01	..	..	..	..	..	..	·03	..	..	..	..	..
2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
3	..	..	..	..	..	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..
4	..	·01	·01	·01	·02	..	..	·02	·01	..	·02	..	..	·01	..	..	..	..	..	·02	·04	·01	·04	·02	..	·01
5	..	..	..	..	..	..	..	·01	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
6	·02	·02	·02	·02	..	..	·03	·01	·01	..	·01	..	·01	·01	·01	·01	..	..	·03	..	·04	·01	·02	·03	·01	..
7	·17	·19	·21	·23	·24	·25	·18	·18	·20	·20	·20	·16	·14	·17	·17	·17	·16	·14	·17	·14	·15	·11	·12	·13	·12	·16
8	..	·01	·06	·01	..	·01	..	·01	..	..	·02	..	..	·02	·01	..	..	..	..	·01	·03	..	·02	..	..	..
9	..	..	..	..	..	..	·02	·01	..	..	..	..	..	..	..	..	·01	..	..	..	..	..	..	..	..	..
10	..	..	·01	·01	·02	·03	·02	·03	·04	..	..	·01	·02	·02	·03	..	..	..	..	..	..	..	..	..	..	..
11	·06	·05	·03	·05	·04	·08	·04	·05	..	·05	·05	·08	·04	·04	·04	·04	·02	·07	·12	·13	·12	·12	·13	·14	·16	·15
12	..	..	·01	..	..	·01	..	·01	..	..	..	..	·01	..	..	..	·03	..	..	..	·02	..	·01	..	..	..
13	·01	..	..	·01	..	..	·01	..	..	..	..	..	..	·01	..	..	·01	..	·02	·01	·05	·02	·03	·04	..	·04
14	·65	·62	·60	·57	·65	·54	·57	·51	·55	·47	·42	·52	·66	·68	·55	·67	·63	·65	·78	·83	·80	·79	·69	·77	·85	·85
15	·14	·16	·16	·18	·19	·18	·18	·14	·15	·13	·13	·12	·14	·16	·15	·14	·25	·16	·15	·17	·17	·14	·11	·13	·15	·17
16	..	..	..	..	..	..	·01	..	..	·01	·01	..	·02	·03	·01	·01	·02	..	..	..	·01	..	·01	·01	..	..
17	·02	·03	·03	·04	·04	·03	·02	·02	·03	·01	·01	·01	·02	·03	·02	·02	·04	..	·03	..	·03	..	·02	·01	·02	·01
18	·11	·13	·16	·15	·16	·15	·15	·11	·15	..	·09	·12	·10	·13	·11	·10	..	·09	·10	·12	·11	·08	·06	·09	·08	·15
19	·06	·02	·04	·02	..	·03	·02	·02	·01	..	·02	·01	..	·02	..	·02	..	·01	..	..	·01	..	..	..	..	..
20	..	..	..	..	..	..	..	..	..	·03	·01	..	..	..	..	..	·04	..	..	..	·02	..	..	..	..	..
21	·22	·23	·25	·27	·32	·29	·24	·14	·23	·23	·20	·18	·23	·23	·19	·22	·14	·22	·23	·22	·23	·17	·11	·18	·20	·24
22	..	..	..	..	..	..	·01	..	..	..	..	·01	..	..	..	..	·02	..	..	..	·01	..	..	..	..	..
23	·08	·09	·11	·10	·08	·09	·08	·07	·10	·07	·04	..	·04	·06	·06	·07	..	·06	·07	·08	·08	·06	·05	·07	..	..
24	·04	·06	·08	·07	·05	·06	·04	·04	·05	·04	·03	..	·05	·06	·04	·03	·03	·05	·02	..	·04	·02	·02	·02	·10	·10
25	..	..	..	..	..	..	..	·08	..	·01	·01	..	..	·01	·01	·01	·04	..	..	·02	..	..	·01	..	..	..
26	·09	·09	·11	·09	·09	·07	·09	·03	·09	·06	·08	·05	·10	·10	·09	·09	·21	·11	·08	·10	·10	·10	·08	·10	·11	·10
27	..	..	..	..	..	..	·01	..	..	..	..	·08	..	·01	..	..	..	..	..	..	..	..	..	..	..	..
28	·08	·07	·07	·04	·09	·05	·12	·09	·12	·08	·11	·03	·10	·10	·13	·17	·09	·07	·11	·09	·10	·05	·02	·05	..	·06
29	·01	..	..	..	..	·01	..	·02	·03	..	·03	..	..	·03	·03	·02	·01	..	·02	..	·03	..	..	..	..	..
30	..	..	..	..	..	..	..	..	..	..	·02	..	..	..	..	..	·01	..	..	..	..	..	..	..	..	..
31	..	..	..	..	..	..	..	..	..	..	·02	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
*	1·76	1·79	1·96	1·87	1·99	1·88	1·84	1·60	1·79	1·39	1·54	1·38	1·68	1·95	1·65	1·79	1·76	1·63	1·93	1·94	2·22	1·68	1·55	1·79	1·80	2·04
†	30·72	32·23	33·83	33·24	35·85	33·24	31·22	29·69	32·86	30·01	28·50	23·13	30·18	30·68	29·60	28·62	...	29·17	29·49	29·54	32·47	25·39	25·80	...	27·67	32·08

* The figures in this row give the totals for the month. † The totals from January 1st.

Daily Rainfall. *50 years (1841-90) mean for Greenwich for Dec. is 1·77 in.* **December, 1894.**

Day of Mo.	Richmond	Wandswth. Common	Streatham	West Norwood	Forest Hill Dartmh.rd.	Forest Hill (Nurseries)	Forest Hill S.&V.W.C.	Eltham	Woolwich	Greenwich	Deptford	Nunhead	Brixton	Battersea
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
1	..	..	..	..	..	..	·01	..	..	..	..	..	..	..
2	..	..	..	..	..	..	..	..	..	..	..	..	..	..
3	..	..	..	..	..	..	..	..	..	..	..	..	..	..
4	·02	·02	..	..	..	..	..	..	..	..	..	..	..	..
5	..	..	..	..	..	..	..	..	..	..	..	..	..	..
6	·02	·03	·02	..	..	·03	·02	·02	·01	·01	·01	·01	·02	·01
7	·18	·17	·15	·15	·14	·19	·17	·18	·15	·16	·15	·15	·16	·14
8	·03	·01	·01	..	..	·02	·01	·01	·01	..	..	..	..	..
9	..	..	..	..	..	..	..	·01	..	..	..	..	..	..
10	..	..	·01	..	..	..	..	·02	..	..	..	..	..	..
11	·13	·13	·09	·08	·09	·08	·08	·08	·12	·08	·07	·07	·10	·10
12	..	..	·01	..	..	·01	·01	..	..	..	..	..	..	..
13	·03	·02	·02	·02	·03	·01	·03	·03	·02	·02	·02	·01	·01	·01
14	·85	·76	·73	·74	·73	·81	·76	·80	·93	·87	·84	·80	·82	·85
15	·14	·16	·15	·15	·16	·17	·16	·15	·14	·17	·15	·13	·06	·13
16	·01	·02	·01	·01	·02	·02	..	·02	..	·01	·01	·01	·09	·01
17	·03	·02	·02	·02	·03	..	·03	·03	·04	·03	·01	·02	·02	·02
18	·10	·11	·09	·11	·16	·15	·10	·13	·11	·16	·15	·08	·13	·14
19	..	·01	·02	·01	..	·02	·01	·01	·01	·01	..	..	..	..
20	..	·01	..	..	..	..	..	..	..	..	..	..	..	..
21	·27	·25	·23	·28	·23	·29	·25	·26	·19	·22	·22	·17	·28	·18
22	..	..	·01	..	..	..	..	..	..	..	..	..	..	..
23	·10	·08	·07	·08	·08	·07	·17	·04	·03	·04	·04	·05	·07	·06
24	·03	·04	·04	·05	·01	·05	·04	·06	·03	·02	·02	..	·05	..
25	..	·02	·01	..	..	..	..	..	..	..	..	·01	..	..
26	·08	·08	·09	·09	..	·10	·09	·09	·06	·06	·05	·06	·09	·07
27	·01	..	..	..	..	..	..	..	..	..	..	..	..	..
28	·05	·05	·05	·07	·05	·06	·06	·05	·05	·05	·04	·06	·05	·08
29	·02	·03	·02	·03	..	·04	·02	·03	·04	·04	·03	·02	·02	·02
30	..	·01	..	..	..	..	..	..	·01	..	..	..	..	..
31	..	..	..	..	..	..	..	..	..	..	..	..	..	..
*	2·10	2·03	1·85	1·89	1·73	2·12	2·02	2·02	1·95	1·95	1·81	1·65	1·97	1·82
†	29·30	28·25	....	28·94	27·67	28·56	26·94	28·13	26·46	26·88	24·57	23·05	28·69	23·11

* The figures in this row give the totals for the month. † The totals from January 1st.

Note.—The observations are taken at 9 a.m., except at Brixton and Addington Park Farm (8 a.m.), Bromley (8.30 a.m.), and Croydon (Waddon New Road) (10 a.m.).

NOTES.

(December, 1894.)

The month was cold at the beginning and end, and wet and warm in the middle. It was rather sunless. The rainfall was not exceptional, being rather below than above the average at most places in the district. The gale on the 23rd did much damage in various parts of the district. At Croydon a solar halo was observed on the 9th; and lunar halos were observed at Croydon on the 9th and 13th, and at Upper Gatton on the 10th. The mean temperature at Croydon (Duppas House) was 41·5°, at Wallington 41°, and at Waddon 40·7°, and is about 3° above the average. There were recorded at Woolwich 15 hours of bright sunshine, and at Wallington 33 hours of sunlight, which latter is 3 per cent. below the average.

Francis Campbell Bayard, F.R.Met.Soc.,
Hon. Sec.

APPENDIX II.

Falls of 1·00 in. and upwards.

April 14th.—Caterham Valley, 1·21 in.

April 24th.—Dorking, 1·00 in.

July 10th.—Purley (Tudor Cottages), 2·03 in.; West Wickham (Wickham Court), 1·95 in.; Croydon (Chatfield Road), 1·89 in.; Croydon (Whitgift), 1·87 in.; Waddon, Croydon (Duppas House), and South Norwood, 1·85 in.; Warlingham, 1·84 in.; Bickley, 1·83 in.; Croydon (Brimstone Barn), 1·82 in.; Wallington, Beddington, Croydon (Outram Road), and Thornton Heath, 1·80 in.; Croydon (Park Hill), 1·77 in.; Addington Hills, 1·74 in.; Croydon (Waddon New Road), 1·73 in.; Addington (Park Farm), 1·72 in.; Kenley and West Norwood, 1·70 in.; Addington (Pumping Station) and Bromley, 1·69 in.; Eltham, 1·68 in.; Coulsdon and Banstead, 1·67 in.; West Wickham (Layham's Farm) and Keston (Bradfield), 1·66 in.; Hayes Common, 1·65 in.; Keston (Tower Fields) and Streatham, 1·63 in.; Sutton, 1·61 in.; Forest Hill (Dartmouth Road), 1·58 in.; Woolwich, 1·57 in.; Beckenham (Foxgrove and Cedars Road), 1·56 in.; Caterham and Forest Hill (Nurseries), 1·55 in.; Orpington and Bromley Common, 1·54 in.; Forest Hill (Southwark and Vauxhall Water Co.), 1·53 in.; Upper Gatton, 1·49 in.; Farningham Hill, 1·48 in.; Epsom, Wimbledon (Sewage Works), and Brixton, 1·46 in.; Ashtead, 1·45 in.; Dorking, 1·43 in.; Deptford, 1·41 in.; Wimbledon (Mt. Ararat), Greenwich, and Nunhead, 1·40 in.; Reigate Hill, 1·39 in.; Wandsworth Common, 1·38 in.; Westerham, Wilmington, Raynes Park, and Kingston, 1·35 in.; Oxshott and Surbiton, 1·25 in.; New Malden, 1·24 in.; Marden Park, 1·17 in.; Battersea, 1·15 in.; Richmond, 1·06 in.; Caterham Valley, 1·00 in.

August 23rd.—Keston (Bradfield and Tower Fields), 1·20 in.; Orpington, 1·11 in.; Bickley, 1·08 in.; West Wickham (Wickham Court), 1·07 in.; West Wickham (Layham's Farm) and Eltham, 1·04 in.; Farningham Hill, 1·02 in.; Reigate Hill, Bromley Common, and West Norwood, 1·00 in.

October 24th.—Dorking, 1·26 in.; Abinger, 1·21 in.; Surbiton, 1·20 in.; Kingston, 1·05 in.

October 30th.—Croydon (Chatfield Road), 2·42 in.; West Wickham (Wickham Court) and Keston (Tower Fields), 1·73 in.; Caterham, 1·63 in.; Keston (Bradfield), 1·60 in.; Warlingham and Banstead, 1·59 in.; Forest Hill (Nurseries), 1·58 in.; Kenley, Ashtead, and Epsom, 1·56 in.; Coulsdon, Addington (Park Farm), and Bickley, 1·55 in.; West Wickham (Layham's Farm), 1·54 in.; Sutton, Wallington, and Beddington, 1·53 in.;

Westerham, Addington Hills, and Addington (Pumping Station), 1·52 in.; Purley (Tudor Cottages) and Wimbledon (Sewage Works), 1·51 in.; Kingston, 1·49 in.; Marden Park, 1·48 in.; Croydon (Duppas House and Whitgift), 1·47 in.; Waddon, Croydon (Park Hill), Beckenham (Cedars Road), and West Norwood, 1·46 in.; Reigate Hill, Bromley, Raynes Park, and Streatham, 1·45 in.; Croydon (Brimstone Barn) and Brixton, 1·44 in.; Forest Hill (Dartmouth Road), 1·43 in.; Wandsworth Common, 1·42 in.; Croydon (Waddon New Road), Thornton Heath, and Surbiton, 1·40 in.; Upper Gatton, Oxshott, Croydon (Outram Road), and Hayes Common, 1·39 in.; Orpington and Farningham Hill, 1·37 in.; Bromley Common, Wimbledon (Mt. Ararat), West Molesey, and Greenwich, 1·36 in.; Richmond and Forest Hill (Southwark and Vauxhall Water Co.), 1·35 in.; Eltham and Nunhead, 1·34 in.; New Malden, 1·33 in.; Deptford, 1·32 in.; Wilmington, 1·30 in.; Esher, 1·28 in.; Woolwich, 1·27 in.; Battersea, 1·22 in.; Dorking, 1·17 in.; Abinger, 1·01 in.

November 12th.—West Wickham (Wickham Court), 1·39 in.; West Wickham (Layham's Farm), 1·30 in.; Caterham, 1·27 in.; Warlingham and Hayes Common, 1·25 in.; Bromley, 1·24 in.; Keston (Bradfield and Tower Fields), 1·23 in.; Kenley, 1·21 in.; Marden Park, Addington (Park Farm), and Bickley, 1·20 in.; Coulsdon, Addington (Pumping Station), and Bromley Common, 1·14 in.; Purley (Tudor Cottages), 1·12 in.; Reigate Hill, 1·08 in.; Beddington, 1·05 in.; Upper Gatton, Croydon (Chatfield Road), and Eltham, 1·03 in.; Croydon (Duppas House), 1·02 in.; Wallington, 1·01 in.; Croydon (Waddon New Road and Whitgift), Addington Hills, and Thornton Heath, 1·00 in.

November 14th.—Caterham, 1·29 in.; Banstead, 1·23 in.; Reigate Hill, 1·22 in.; West Wickham (Wickham Court), 1·20 in.; Coulsdon and Kenley, 1·18 in.; Hayes Common, 1·15 in.; Abinger, 1·13 in.; Orpington, 1·12 in.; Wallington, 1·11 in.; Addington (Pumping Station), 1·10 in.; Warlingham and Croydon (Duppas House and Outram Road), 1·09 in.; Croydon (Park Hill), and Bickley, 1·08 in.; Beddington, Croydon (Whitgift), Keston (Tower Fields), and Bromley, 1·06 in.; Sutton, Waddon, and Croydon (Waddon New Road), 1·04 in.; Addington Hills and Farningham Hill, 1·02 in.; Croydon (Chatfield Road), 1·01 in.; Dorking and Westerham, 1·00 in.

Well Gaugings in the Croydon District.

Communicated by Thomas Walker, M. Inst. C. E., Borough Engineer.

All levels are given in feet above Ordnance Datum.

	Warlingham		Kenley Valley					Brighton Rd. Valley		
	Slynes Oaks	Crewes Farm	Bughill Farm	Marden Lodge	Well Farm	Garston House	Gt. Roke Farm	Rsl. Hill F. Cot.	Purley-bury	Croham Villas
Level of Mouth	591·8	560·4	375·5	354·2	333·1	276·7	236·4	221·1	207·2	265·3
Bottom	267·6	231·2	253·5	240·2	224·1	206·7	185·9	173·1	164·0	184·8
1889.										
Jan. 14	—	—	294·7	288·5	283·2	242·7	204·2	181·1	175·0	195·5
Feb. 9–15	333·8	286·3	304·5	296·7	290·6	246·8	206·4	183·2	176·6	196·6
Mar. 28–29	359·1	305·1	330·5	318·4	308·9	255·2	211·9	185·3	179·9	199·0
May 3–4	349·4	302·7	324·9	316·6	308·7	257·7	214·4	187·0	181·6	199·9
June 4–5	341·8	295·6	318·1	310·9	304·2	256·1	213·6	186·2	180·9	199·2
July 4–5	330·8	288·6	306·1	301·4	296·2	252·7	211·2	185·2	179·3	197·9
Aug. 16–17	316·7	273·0	286·4	284·2	281·2	245·7	206·7	182·3	176·7	195·5
Oct. 8–9	309·2	257·0	266·5	265·9	263·7	234·9	200·5	179·1	172·5	192·9
Nov. 11–12	307·6	251·4	258·9	259·0	256·7	228·8	197·7	177·7	170·9	190·9
Nov. 23	308·0	—	259·2	258·3	256·1	227·6	196·8	—	170·2	190·5
Dec. 9–10	308·1	250·8	259·1	258·3	255·7	226·9	195·8	176·9	170·0	190·3
Dec. 23–24	307·7	251·3	258·6	257·6	255·4	226·6	195·7	176·7	169·7	190·3
1890.										
Jan. 27–28	314·8	262·6	276·0	271·9	267·7	231·2	196·6	177·5	170·6	192·1
Mar. 1–6	333·9	283·6	303·6	295·4	288·6	242·2	203·1	179·9	174·1	195·3
Apr. 18–19	343·3	292·6	315·2	306·0	298·5	249·5	207·9	182·5	177·1	197·1
May 16–17	339·8	292·8	314·1	306·2	299·5	251·4	209·3	183·3	177·9	197·4
June 18–19	331·8	287·9	307·2	301·5	295·7	250·9	209·0	183·2	177·6	196·9
July 12–14	323·3	280·3	298·3	294·8	290·3	248·9	207·9	182·7	177·1	196·2
Aug. 9–11	319·3	273·6	291·3	287·9	283·8	245·1	205·8	181·7	175·9	195·7
Sept. 9–10	316·2	270·0	284·2	281·3	277·9	241·6	203·7	180·4	174·6	194·9
Oct. 8–10	312·4	263·6	274·6	272·9	269·8	237·2	201·4	179·1	173·0	193·7
Nov. 5–6	309·1	256·8	266·1	265·1	262·7	232·6	199·0	177·8	171·6	191·6
Dec. 2–3	306·7	250·8	258·3	258·1	256·0	228·1	197·0	177·1	170·3	190·0
1891.										
Feb. 5–6	305·4	248·3	259·8	256·5	253·2	219·8	192·6	174·8	167·8	186·6
Mar. 9	311·8	258·6			(Bliz	zard)				
Apr. 3–6	316·4	264·3	281·3	275·6	270·9	232·6	197·9	177·2	170·8	192·0
May 4–5	316·0	265·6	280·0	276·1	272·4	235·8	199·9	178·7	172·1	193·3
May 30–June 1	311·1	261·6	273·1	270·8	267·9	235·1	199·9	178·6	172·1	192·5
June 27–29	308·1	255·6	266·3	264·2	261·9	231·2	198·3	177·7	171·1	190·8
Aug. 6–7	305·3	248·8	256·5	255·8	253·7	225·0	195·5	176·2	169·5	188·4
Aug. 22–24	304·5	246·5	254·4	253·6	251·8	222·5	194·4	175·8	168·8	187·5
Sept. 11–12	305·9	249·9	261·5	259·0	255·9	222·6	194·0	175·6	168·5	187·5
Oct. 13–14	308·8	255·0	267·3	264·6	261·4	227·1	195·6	176·3	169·2	189·3
Nov. 9–10	354·0	291·2	322·8	307·4	297·2	242·2	202·5	179·7	173·5	194·8
Dec. 11–12	370·5	315·5	343·7	329·4	317·7	257·3	212·8	185·6	180·2	199·8

	WARLINGHAM		KENLEY VALLEY					BRIGHTON RD. VALLEY		
	Slynes Oaks	Crewes Farm	Bughill Farm	Marden Lodge	Well Farm	Garston House	Gt. Roke Farm	Rsl. Hill F. Cot.	Purley-bury	Croham Villas
Level of Mouth	591·8	560·4	375·5	354·2	333·1	276·7	236·4	221·1	207·2	265·3
Bottom	267·6	231·2	253·5	240·2	224·1	206·7	185·9	173·1	164·0	184·8
1892.										
Feb. 12–13	362·1	318·1	344·6	336·0	324·3	261·6	224·1	193·7	187·1	201·5
Mar. 4–5	349·7	308·7	331·6	324·8	316·1	260·1	221·7	191·9	185·6	200·0
Apr. 6–7	328·6	287·8	307·0	301·1	294·8	247·1	205·6	178·3	172·6	189·1
May 6–7	320·3	279·3	296·7	292·0	286·7	243·3	202·3	176·2	170·4	187·9
June 11–13	308·3	266·7	282·0	279·5	275·7	238·1	198·5	173·8	167·7	186·2
July 11–12	304·3	268·1	271·4	269·7	266·7	231·9	195·0	Dry	165·6	185·2
Aug. 12–13	303·2	266·9	267·2	267·0	264·9	229·6	193·9	Dry	Dry	184·9
Sept. 22–23	301·9	257·4	261·4	260·8	258·1	228·5	193·0	Dry	Dry	Dry
Oct. 24–25	299·8	251·4	259·5	258·9	255·7	226·2	192·2	Dry	Dry	Dry
Nov. 25–30	336·8	290·4	305·5	291·5	283·1	234·4	198·4	178·7	172·5	194·5
Dec. 30–31	353·3	296·8	323·1	309·5	300·3	245·8	204·4	180·4	174·8	196·6
1893.										
Mar. 2–3	360·8	306·6	333·0	320·6	311·3	255·8	211·6	185·2	179·7	219·5
Apr. 17–18	361·5	314·5	341·2	331·9	320·7	261·6	218·8	189·3	183·7	221·2
May 11–12	347·0	303·4	325·5	317·3	309·7	260·2	216·2	187·1	181·6	218·8
June 20–21	322·8	284·1	300·2	296·7	292·8	250·2	209·9	184·5	178·6	216·8
Aug. 9–10	310·5	256·1	273·1	271·5	290·6	238·5	202·5	179·5	173·7	204·0
Oct. 3–4	304·5	246·8	Dry	251·1	248·4	221·2	192·9	173·7	169·2	189·0
Nov. 8–9	292·8	243·4	Dry	244·0	242·4	216·7	192·3	173·1	167·3	185·5
Dec. 7–8	292·3	241·4	Dry	241·5	237·3	211·7	189·7	Dry	165·9	185·3
1894.										
Jan. 25– Feb. 13	305·8	264·6	Dry	247·5	244·7	211·5	188·9	173·8	165·7	186·3
Mar. 3–5	330·2	276·2	297·2	288·2	281·5	234·1	198·2	177·6	170·9	194·0
Apr. 6–7	330·8	282·4	302·9	295·1	288·8	—	203·2	179·7	174·1	195·8
May 8–9	321·8	279·1	296·8	292·2	286·9	—	205·3	181·1	175·2	196·6
June 12–13	310·1	269·0	283·1	281·1	277·6	—	203·9	183·5	174·0	195·0
July 19–20	309·3	259·2	270·5	269·1	266·8	—	200·6	178·9	172·5	191·5
Aug. 28–29	306·2	250·5	259·7	259·2	257·2	—	197·0	177·5	169·9	188·7
Oct. 1–2	303·8	246·2	253·5	252·7	251·7	—	194·6	176·0	168·5	187·0
Nov. 8–9	305·8	covered over	261·0	267·5	255·3	—	193·3	175·5	168·2	187·3
Dec. 5–6	360·8	,,	332·7	314·7	295·5	—	205·9	181·3	176·1	196·9

	Addington	Wickham						Addington	Selsdon	Warlingham
	Addington Village	Sparrow's Den.	Wickham Court	Rouse Farm	Nashe	Wait's Farm	Layham's Farm	Addington Lodge F.	Selsdon	Kennel Farm
Level of Mouth	267·3	226·4	299·8	317·4	337·9	372·0	509·6	491·3	438·6	605·7
Bottom	202·2	176·4	178·5 bore 93·0	180·4	182·9	190·1	218·6	242·3	194·4	316·7
1889.										
Jan. 14	—	—	—	—	—	—	—	—	—	—
Feb. 9–15	213·8	184·9	189·9	193·1	202·0	206·2	249·1	253·7	230·7	353·7
Mar. 28–29	221·1	188·2	193·7	198·2	209·3	213·1	251·2	265·3	240·1	359·4
May 3–4	225·5	191·4	196·8	202·0	213·6	217·1	252·3	—	245·5	363·7
June 4–5	225·7	192·7	198·3	203·1	213·6	216·9	253·0	—	243·9	365·4
July 4–5	223·5	193·0	198·2	202·4	212·2	215·3	250·1	262·2	239·8	362·2
Aug. 16–17	218·3	191·8	195·9	198·6	207·3	212·0	248·6	254·7	231·9	359·4
Oct. 8–9	209·6	187·4	191·2	192·8	198·9	203·1	247·5	247·5	219·2	353·2
Nov. 11–12	206·1	185·1	188·5	189·4	195·1	199·1	246·5	243·6	210·9	350·1
Nov. 23	—	—	—	—	—	—	—	—	—	349·3
Dec. 9–10	204·8	183·5	186·8	187·8	193·4	197·8	245·6	Dry	207·7	348·4
Dec. 23–24	203·0	182·9	186·3	187·5	192·7	197·6	245·7	242·3	207·4	347·7
1890.										
Jan. 27–28	205·4	182·4	186·3	187·7	194·2	198·7	246·0	245·7	210·6	346·3
Mar. 1–6	211·4	184·1	188·6	191·6	199·7	204·0	247·9	252·5	226·0	347·1
Apr. 18–19	216·3	186·8	191·8	195·5	204·8	209·2	249·2	258·2	233·1	354·4
May 16–17	218·3	188·0	193·2	197·2	207·1	211·0	249·5	260·7	235·7	358·6
June 18–19	218·0	188·7	193·6	197·4	206·9	210·7	250·6	259·2	235·2	359·4
July 12–14	216·2	188·4	192·5	196·4	205·3	209·3	250·2	255·3	231·7	360·8
Aug. 9–11	213·9	187·5	191·9	194·6	202·6	206·9	249·2	252·4	228·8	358·3
Sept. 9–10	211·9	186·0	190·3	192·8	200·4	204·6	249·0	251·1	226·0	356·9
Oct. 8–10	208·7	184·7	188·6	190·7	197·6	202·0	248·5	248·4	221·9	355·2
Nov. 5–6	205·7	183·0	186·7	188·3	194·4	199·2	247·3	245·2	215·2	352·0
Dec. 2–3	Dry	181·7	184·9	185·9	191·5	196·1	246·3	Dry	208·4	348·4
1891.										
Feb. 5–6	Dry	177·3	181·1	181·3	186·5	191·7	242·0	Dry	199·7	340·7
Mar. 9	Dry	177·0	181·2	181·7	188·0	192·6	243·1	Dry	204·1	338·5
Apr. 3–6	Dry	177·7	182·3	183·1	191·9	194·3	244·3	243·9	209·6	339·4
May 4–5	204·3	178·1	183·1	184·5	191·7	196·0	246·0	245·7	216·3	340·4
May 30– June 1	204·2	178·7	183·3	184·4	191·5	196·9	246·5	245·3	216·6	341·6
June 27–28	Dry	177·3	182·0	182·8	189·4	195·1	245·7	Dry	209·1	341·4
Aug. 6–7	Dry	Dry	180·2	180·9	186·5	192·7	242·8	Dry	203·2	340·8
Aug. 22–24	Dry	Dry	179·5	Dry	185·6	191·7	241·8	Dry	201·4	340·8
Sept. 11–12	Dry	Dry	178·9	Dry	184·9	190·8	241·1	242·3	201·3	340·1
Oct. 13–14	Dry	Dry	178·7	Dry	185·4	191·1	241·5	243·5	203·7	339·7
Nov. 9–10	Dry	Dry	180·7	183·2	190·6	193·1	245·0	249·4	216·4	344·0
Dec. 11–12	217·2	181·7	185·0	194·3	204·0	208·0	249·0	264·5	238·9	355·3
1892.										
Feb. 12–13	232·8	193·3	201·0	206·8	221·9	222·5	261·0	278·3	255·2	375·4
Mar. 4–5	229·3	193·4	200·8	206·9	219·5	220·5	260·6	273·3	250·3	372·7
Apr. 6–7	217·3	184·9	200·1	195·1	206·4	209·1	246·5	258·7	234·9	356·9
May 6–7	214·4	184·1	199·2	193·1	203·3	206·5	243·8	255·1	231·1	352·5
June 11–13	208·9	182·3	193·8	185·1	198·7	202·2	241·5	248·1	224·1	348·0
July 11–12	205·5	180·3	—	185·1	194·8	198·7	240·1	243·7	219·1	347·2

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	Addington	Wickham						Addington.	Selsdon	Warlingham
	Addington Village	Sparrow's Den	Wickham Court	Rouse Farm	Nashe	Wait's Farm	Layham's Farm	Addington Lodge F.	Selsdon	Kennel Farm
Level of Mouth	267·3	226·4	299·8	317·4	337·9	372·0	509·6	491·3	438·6	605·7
Bottom	202·2	176·4	178·5 bore 93·0	180·4	182·9	190·1	218·6	242·3	194·4	316·7
1892.										
Aug. 12–13	204·7	179·7	192·2	184·0	192·5	197·0	239·8	242·9	218·1	346·0
Sept. 22–23	204·4	179·4	188·9	182·5	190·8	194·0	238·6	Dry	213·1	344·7
Oct. 24–25	204·0	178·9	186·8	181·6	189·9	193·4	236·3	Dry	211·4	343·9
Nov. 25–30	206·8	182·1	187·7	187·5	194·9	198·5	246·5	248·3	214·5	350·2
Dec. 30–31	215·6	185·1	190·5	193·5	202·5	207·1	248·4	257·3	230·1	352·6
1893.										
Mar. 2–3	224·2	191·3	197·7	201·0	212·3	216·0	252·6	267·6	242·7	366·3
Apr. 17–18	232·5	196·5	203·5	208·3	222·9	223·5	259·6	276·9	253·8	371·1
May 11–12	229·9	197·6	204·6	208·1	220·4	222·1	259·8	272·7	240·1	railed in
June 20–21	221·9	196·1	201·4	203·9	213·6	216·6	254·8	263·2	238·9	,,
Aug. 9–10	213·2	190·8	195·1	196·3	203·3	212·6	247·5	251·3	225·4	,,
Oct. 3–4	202·2	185·2	189·1	188·4	193·7	198·2	243·5	246·7	208·6	,,
Nov. 8–9	Dry	182·0	185·1	185·2	190·8	194·2	241·1	246·1	203·7	,,
Dec. 7–8	Dry	179·7	183·7	182·3	186·6	193·6	240·9	244·3	201·4	,,
1894.										
Jan. 25–Feb. 13	Dry	178·2	182·5	182·1	189·3	192·8	240·6	248·0	201·6	,,
Mar. 3–5	Dry	179·3	184·4	186·1	193·1	196·5	244·2	249·0	214·6	,,
Apr. 6–7	209·3	181·3	187·0	188·9	197·9	202·1	248·4	251·9	225·6	,,
May 8–9	211·3	182·6	188·6	190·9	199·9	204·3	248·1	253·3	228·6	,,
June 12–13	209·3	182·3	188·2	189·8	197·9	202·8	247·1	251·4	225·3	,,
July 19–20	204·7	180·6	185·6	186·9	193·4	199·3	246·8	249·3	217·0	,,
Aug. 28–29	Dry	178·2	183·0	183·2	188·9	195·4	244·6	248·1	208·6	,,
Oct. 1–2	Dry	Dry	181·3	181·3	186·4	192·2	243·1	247·0	204·0	,,
Nov. 8–9	Dry	Dry	180·3	Dry	184·8	192·3	241·8	245·6	201·4	,,
Dec. 5–6	209·3	178·7	185·3	187·3	196·7	199·4	246·6	254·5	225·1	,,

6

CONTENTS.

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